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Annual List of Periodicals

U.S. ENVIRONMENTAL PROTECTION AGENCY

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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

Publication of an abstract, annotation, or citation does not imply endorsement by the Environmental Protection Agency of the original article or of commercial materials, equipment, or processes mentioned therein.

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PESTICIDES ABSTRACTS

Preface

Included in this issue is a list of sources from which at least one article was abstracted for publication in either Volume 8 (1975) or Volume 9 (1976); however, more than 2500 primary serials and secondary sources, books and non-periodical publications are screened. Journal titles are abbreviated according to the format of Chemical Abstracts' Bibliographic Guide for Editors and Authors. Japanese publications are listed by the Hepburn romanization of the complete title which is followed by the English equivalent, abbreviated according to the Bibliographic Guide in parentheses. For additional convenience, English titles of Japanese periodicals are listed separately and cross-referenced.

ACTA AGRIC SCAND
ACTA AGRON (PALMIRA)
ACTA BIOL ACAD SCI HUNG
ACTA BIOL MED GER
ACTA BOT
ACTA CIENT COMPOSTELANA
ACTA EMBRYOL EXP
ACTA ENTOMOL BOHEMOSLOV
ACTA HAEMATOL
ACTA HEPATO-GASTROENTEROL
ACTA HISTOCHEM
ACTA HYDROCHIM HYDROBIOL
ACTA MED IUGOSL
ACTA MICROBIOL POL
ACTA MORPHOL ACAD SCI HUNG
ACTA NEUROPATHOL
ACTA PARASITOL POL
ACTA PHARM HUNG
ACTA PHARM JUGOSL
ACTA PHARMACOL TOXICOL
ACTA PHYSIOL ACAD SCI HUNG
ACTA PHYSIOL LAT AMER
ACTA PHYSIOL POL
ACTA PHYSIOL SCAND
ACTA PHYTOPATHOL
ACTA POL PHARM
ACTA VET (BRNO)
ACTA VET (BUDAPEST)
ACTA VET SCAND
ACTIV NERV SUPER
ADSORBTSIYA ADSORBENTY
ADV AGRON
ADV APPL MICROBIOL
ADV INSECT PHYSIOL
ADV INTERN MED
AEROSP MED
AFINIDAD
AGRESSOLOGIE
AGRIC AM
AGRIC AVIAT
AGRIC BIOL CHEM (TOKYO)
AGRIC CHEM MON SEE KONGETSU NO NOYAKU
AGRIC ENVIRON
AGRIC N IREL
AGRIC RES
AGRICHEM AGE
AGROCHEMIA (PRAGUE)
AGROCHIMICA
AGROKEM TALAJTAN
AGROKHIMIYA
AGRON J
AICHE SYMP SER
AIN SHAMS MED J
AKAD WISS LIT MAINZ ABH MATH-NATURWISS KL
AKITA J RURAL MED SEE AKITA-KEN NOSON IGAKKAI ZASSHI
AKITA-KEN NOSON IGAKKAI ZASSHI
AKUSH GINEKOL (SOFIA)
ALIMENT VIE
ALLG FORST JAGDZTG
ALLG FORSTZ
AM BEE J
AM IND HYG ASSOC J
AM J DIS CHILD
AM J ENOL VITIC
AM J PATHOL
AM J PHYSIOL
AM J PSYCHIATRY
AM J TROP MED HYG
AM J VET RES
AM MIDL NAT
AM REV RESPIR DIS
AM ZOOL
AMBIO
AN QUIM
ANAL BIOCHEM
ANAL CHEM
ANAL CHIM ACTA
ANAL INSTRUM
ANAL LETT
ANALYSIS
ANALYST (LONDON)
ANAT REC
ANGEW CHEM INT ED ENGL
ANN ACFAS (ASS CAN FR AVAN SCI)
ANN AGRIC FENN
ANN APPL BIOL
ANN BIOL ANIM BIOCHIM BIOPHYS
ANN FALSIF EXPERT CHIM
ANN HYDROBIOL
ANN INT MED
ANN MED VET
ANN N Y ACAD SCI
ANN NUTR ALIMENT
ANN PEDIATR SEE SEM HOP
ANN TROP MED PARASITOL
ANN ZOOL ECOL ANIM
ANN ZOOL FENN
ANNEE ENDOCRINOL
ANNU REP SANKYO RES LAB SEE SANKYO KENKYUSHO NENPO
ANNU REP TOKYO METROP LAB PUBLIC HEALTH SEE TOKYO-TORITSU EISEI KENKYUSHO KENKYU NENPO
ANNU REP YAMANASHI PREFECT INST PUBLIC HEALTH SEE YAMANASHI KENRITSU EISEI KENKYUSHO NENPO
ANNU REV BIOCHEM

ANNU REV PHARMACOL
ANNU REV PLANT PHYSIOL
ANTIOQ MED
ANZ SCHAEDLINGSKD PFLANZEN-UMWELTSCHUTZ
APIDOLOGIE
APPL ENTOMOL ZOOL
APPL ENVIRON MICROBIOL
APPL MICROBIOL
ARCH BIOCHEM BIOPHYS
ARCH DERMATOL
ARCH ENVIRON CONTAM TOXICOL
ARCH ENVIRON HEALTH
ARCH EXP VETERINAERMED
ARCH GESCHWULSTFORSCH
ARCH INST CARDIOL MEX
ARCH INT PHARMACODYN THER
ARCH INT PHYSIOL BIOCHIM
ARCH KLIN EXP DERMATOL
ARCH MAL PROF MED TRAV SECUR SOC
ARCH MIKROBIOL
ARCH PATHOL
ARCH PHARM (WEINHEIM GER)
ARCH TOXIKOL
ARCH VET
ARCH VET ITAL
ARCTIC
ARH HIG RADA TOKSIKOL
ARKH ANAT GISTOL EMBRIOL
ARQ INST BIOL (SAO PAULO)
ASIAN MED J
ATMOS ENVIRON
ATTI SOC ITAL SCI VET
AUK
AUST J BIOL SCI
AUST J DAIRY TECHNOL
AUST J EXP AGRIC ANIM HUSB
AVIAN DIS
BEE WORLD
BEHAV BIOL
BEITR GERICHTL MED
BEITR TABAKFORSCH
BERUFS-DERMATOSEN
BIOCHEM BIOPHYS RES COMMUN
BIOCHEM J
BIOCHEM PHARMACOL
BIOCHEMISTRY
BIOCHIM BIOPHYS ACTA
BIOKHIMIYA
BIOL CONSERV
BIOL GLAS
BIOL NAUKI
BIOL RUNDSCH
BIOLOGIA
BIOLOGICO
BIOSCIENCE
BITKI KORUMA BUL
BIUL INST OCHR ROSL
BIUL WARZYWNICZY
BOCHU-KAGAKU SEE SCI PEST CONTROL
BODENKULTUR
BOEI EISEI
BOL ASSOC MED P R
BOL OF SANIT PANAM
BULL LAB CHIM PROV
BULL SOC ITAL BIOL SPER
BORGYOGY VENEROL SZ
BR J ANAESTH
BR J CLIN PRACT
BR J DERMATOL
BR J EXP PATHOL
BR J HAEMATOL
BR J IND MED
BR J PHARMACOL
BR J PREV SOC MED
BR MED BULL
BR MED J
BR POULT SCI
BR VET J
BRAIN NERVE SEE NO TO SHINKEI
BRAIN RES
BRATISL LEK LISTY
BROMATOL CHEM TOKSYKOL
BUDAPESTI KOZEGESZEGUGY
BULL ACAD NATL MED PARIS
BULL ACAD POL SCI
BULL ACAD VET FR
BULL AGRIC CHEM INSP STN
    SEE NOYAKU KENSASHO HOKOKU
BULL CHEM SOC JPN
BULL ENTOMOL RES
BULL ENVIRON CONTAM TOXICOL
BULL GRAIN TECHNOL
BULL INST PUBLIC HEALTH (TOKYO)
BULL MAR SCI
BULL MT DESERT ISL BIOL LAB
BULL PHYSIO-PATHOL RESPIR
BULL SOC CHIM FR
BULL SOC FR DERMATOL SYPHILIGR
BULL SOC ZOOL FR
BULL TRAV SOC PHARM
BULL WHO
BUNDESGESUNDHEITSBLATT
BUNSEKI KAGAKU SEE JPN ANAL
BUR SPORT FISH WILDL SPE SCI RE
BUR SUGAR EXP STN QUEENSL
BYULL EKSP BIOL MED
C R HEBD SEANCES ACAD SCI PARIS SER D
C R SEANCES ACAD AGRIC FR
C R SEANCES SOC BIOL SES FIL
CALIF AGRIC
CALIF FISH GAME
CALIF MAR RES COMMUN
CAN ENTOMOL
CAN FIELD-NAT
CAN FOR SERV CHEM CONTR RES INS
CAN HOSP
CAN INST FOOD TECHNOL J
CAN J BIOCHEM
CAN J COMP MED
CAN J GENET CYTOL
CAN J MICROBIOL
CAN J PHYSIOL PHARMACOL
CAN J PLANT SCI
CAN J PUBLIC HEALTH
CAN J SOIL SCI
CAN J ZOOL
CANCER
CANCER (TOKYO) SEE GANN
CANCER CHEMOTHER REP
CANCER RES
CASE HIST SEE KANJIE
CENT AFR J MED
CEREAL CHEM
CEREAL SCI TODAY

CESK DERMATOL
CESK FYSIOL
CESK HYG
CEYLON MED J
CHEM AGE INDIA
CHEM ANAL (WARSAW)
CHEM-BIOL INTERACT
CHEM BR
CHEM CONTR RES INST REP
CHEM ENG (LONDON)
CHEM ENG NEWS
CHEM IND (LONDON)
CHEM IND (TOKYO) SEE KAGAKU KOGYO
CHEM LISTY
CHEM PAP PROCESS
CHEM PHARM BULL
CHEM PRUM
CHEM RUNDSCH
CHEM TECH (AMSTERDAM)
CHEM TECH (LEIPZIG)
CHEM UNSERER ZEIT
CHEM WEEKBL
CHEM-ZTG CHEM APPAR
CHEMISTRY
CHEMOSPHERE
CHEST
CHIM ACTUAL
CHIMIA
CHIRURGIE
CHROMATOGRAPHIA
CLIN BIOCHEM
CLIN CHEM
CLIN CHIM ACTA
CLIN ELECTROENCEPHALOGR SEE RINSHO NOHA
CLIN MED
CLIN PEDIATR
CLIN PHARMACOL THER
CLIN RADIOL
CLIN RES
CLIN TOXICOL
COLLECT CZECH CHEM COMMUN
COMMUNITY HEALTH (BRISTOL)
COMP BIOCHEM PHYSIOL
COMP GEN PHARMACOL
COMPOST SCI
CONCOURS MED
CONDOR
CONGENITAL ANOMALIES SEE SENTEN IJO
CONTRIB IST RIC AGRAR MILAN
COPEIA
CORNELL VET
CRIT REV ENVIRON CONTROL
CRIT REV FOOD TECHNOL
CRIT REV TOXICOL
CROP SCI
CROPS SOILS MAG
CURR FARM ECON
CURR SCI
CYTOBIOS
CZAS STOMATOL
DEV IND MICROBIOL
DISS ABSTR INT B
DOKL AKAD NAUK SSSR
DOKL BOLG AKAD NAUK
DOKL BULG AKAD NAUK
DOKL ISKRA
DOKL VSES AKAD SEL'SKH NAUK
DOPOV AKAD NAUK UKR RSR SER B
DRUG METAB DISPOS
DRUG METAB REV
DTSCH GESUNDHEITSWES
DTSCH GEWASSERKD MITT
DTSCH LEBENSM-RUNDSCH
DTSCH MED WOCHENSCHR
DTSCH TIERAERZTL WOCHENSCHR
EAST AFR MED J
ECON MED ANIM
EGESZSEGTUDOMANY
EGYPT J GENET CYTOL
EGYPT J MICROBIOL
EISEI KAGAKU (J HYG CHEM)
EISEI SHIKENJO HOKOKU (BULL NATL INST HYG SCI)
EIYO TO SHOKURYO (FOOD NUTR)
EKSP MED MORFOL
ELECTROENCEPHALOGR CLIN NEUROPHYSIOL
ELELMISZERVIZSGALATI KOZL
EMERG MED
ENDOCRINOLOGY
ENVIRON BIOL
ENVIRON CONSERV
ENVIRON CREATION SEE KANKYO SOZO
ENVIRON ENTOMOL
ENVIRON HEALTH PERSPECT
ENVIRON LETT
ENVIRON PHYSIOL BIOCHEM
ENVIRON POLLUT
ENVIRON QUAL MAG
ENVIRON RES
ENVIRON SCI TECHNOL
ENVIRONMENT
ERNAEHRUNGSFORSCHUNG
EUR J IMMUNOL
EUR J PHARMACOL
EUR J TOXICOL SEE J EUR TOXICOL
EVOL MED
EXP AGRIC ANIM HUSB
EXP CELL RES
EXP EYE RES
EXP MOL PATHOL
EXP PARASITOL
EXP PATHOL
EXPERIENTIA
FACHLICHE MITT OESTERR TABAKREGIE
FAO AQUACULT BULL
FAO PLANT PROT BULL
FARM CHEM
FARM ZH (KIEV)
FARMACO (ED PRAT)
FARMACO (ED SCI)
FARMAKOL TOKSIKOL (MOSCOW)
FARMATSIYA (MOSCOW)
FARUMASHIA (PHARMACY)
FDA (FOOD DRUG ADM) PAP
FEBS LETT
FED PROC FED AM SOC EXP BIOL
FETTE SEIFEN ANSTRICHM
FIRE COMMAND
FISH BULL
FIZIOL AKT VESHCHESTVA
FIZIOL BIOKHIM KUL'T RAST
FIZIOL NORM PATOL
FIZIOL ZH (KIEV)
FLEISCHWIRTSCHAFT
FLUORIDE

FOLIA BIOL (PRAGUE)
FOLIA ENDOCRINOL JPN
  SEE NIPPON NAIBUMPI GAKKAI ZASSHI
FOLIA ENTOMOL MEX
FOLIA MED (NAPLES)
FOLIA MED (PLOVDIV)
FOLIA MED BIALOSTOC
FOLIA MED CRAKOV
FOLIA MORPHOL (WARSAW)
FOLIA OPHTHALMOL JPN SEE NIPPON GANKA KIYO
FOLIA PHARMACOL JPN SEE
    NIPPON YAKURIGAKU ZASSHI
FOOD COSMET TOXICOL
FOOD DRUG COSMET LAW J
FOOD NUTR SEE EIYO TO SHOKURYO
FORTSCHR VETERINAERMED
FORTSCHR WASSERCHEM IHRER GRENZGEB
FRESENIUS Z ANAL CHEM
FRESHWATER BIOL
FUKUOKA ACTA MED
G IG MED PREV
GANKA RINSHO IHO (JPN REV CLIN OPHTHALMOL)
GANN (CANCER)
GANN MONOGRAPH CANCER RES
GARTENBAU
GARTENBAUWISSENSCHAFT
GAS WASSER ABWASSER
GAS-WASSERFACH WASSER-ABWASSER
GASTROENTEROLOGY
GAZ MED FR
GAZ WODA TECH SANIT
GENETICS
GENETIKA
GESUNDH-ING
GETREIDE MEHL
GEWAESSERSCH WASSER ABWASSER
GIDROBIOL ZH
GIG PRIMEN TOKSIKOL PEST KLIN
GIG SANIT
GIG TR PROF ZABOL
GIT FACHZ LAB
GRADINAR LOZAR NAUKA
GRASAS ACEITES (SEVILLE)
GROUND WATER
GYOGYSZERESZET
GYOMU NEMPO KANAGAWA-KEN NOGYO
HAREFUAH
HARYANA AGRIC UNIV J RES
HAUTARZT
HEMBA POL
HIDROBIOLOGIA
HIPPOKRATES
HIROSAKI IGAKU (HIROSAKI MED J)
HIROSAKI MED J SEE HIROSAKI IGAKU
HISTOCHEMISTRY
HOKKAIDORITSU EISEI KENKYUSHO-HO
  (REP HOKKAIDO INST PUBLIC HEALTH)
HOPPE-SEYLERS Z PHYSIOL CHEM
HORTSCIENCE
HRANA ISHRANA
HUM HYG SEE MINZOKU EISEI
HUMANGENETIK
HWAHAK KWA KONGOP UI CHINBO
   (PROGR CHEM CHEM IND)
HYDROBIOLOGIA
IBARAKI DAIGAKU NOGAKUBU GAKUJU
IEEE TRANS AEROSP ELECTRON SYST
IG MOD
IG SANIT PUBBLICA
IGAKU TO SEIBUTSUGAKU (MED BIOL)
IGIENA
IIRB
ILL MED J
IN VITRO
IND ALIMENT (PINEROLO ITALY)
IND ALIMENT AGRIC
IND MED SEE SANGYO IGAKU
INDIAN FOOD PACKER
INDIAN J AGRIC SCI
INDIAN J BIOCHEM BIOPHYS
INDIAN J ENTOMOL
INDIAN J ENVIRON HEALTH
INDIAN J EXP BIOL
INDIAN J IND MED
INDIAN J MED RES
INDIAN J MED SCI
INDIAN J PUBLIC HEALTH
INDIAN PEDIATR
INDIAN PHYTOPATHOL
INDIAN SCI CONGR ASSOC PROC
INDIAN VET J
INDIANA AGRIC EXP STN INSP REP
INFECT IMMUN
INGENIEURSBLAD
INQUINAMENTO
INT ARCH ARBEITSMED
INT BIODETERIOR BULL
INT CHEM ENG
INT J BIOCHEM
INT J CANCER
INT J ENVIRON ANAL CHEM
INT J ENVIRON STUD
INT J NEUROSCI
INT J PARASITOL
INT PEST CONTROL
INTERNIST
INVEST PESQ
ISOTOPENPRAXIS
ISR J ENTOMOL
ISR J MED SCI
IZV AKAD NAUK AZ SSR SER BIOL
IZV AKAD NAUK SSSR SER BIOL
IZV AKAD NAUK SSSR SER KHIM
IZV AKAD NAUK TURKM SSR
IZV TIMIRYAZEV SKH AKAD
J AGRIC CHEM SOC JPN SEE
    NIPPON NOGEI KAGAKU KAISHI
J AGRIC FOOD CHEM
J AGRIC SCI
J AGRIC SCI (TOKYO) SEE NOGYO GIJUTSU (TOKYO)
J AGRIC UNIV P R
J AIR POLLUT CONTROL ASSOC
J ALA ACAD SCI
J AM MED ASSOC
J AM OIL CHEM SOC
J AM PHARM ASSOC
J AM SOC CIV ENG
J AM SOC HORTIC SCI
J AM VET MED ASSOC
J AM WATER WORKS ASSOC
J ANIM SCI
J ANTIBIOT
J APPL ECOL
J ARGENT TOXICOL ANAL ALTAS
J ASSOC OFF ANAL CHEM

J AUST ENTOMOL SOC
J BACTERIOL
J BIOCHEM (TOKYO)
J BIOL CHEM
J CELL BIOL
J CHROMATOGR
J CHROMATOGR SCI
J CLIN ENDOCRINOL METAB
J DAIRY RES
J DAIRY SCI
J DRUG RES EGYPT
J ECON ENTOMOL
J EGYPT MED ASSOC
J ENVIRON ECON MANAGE
J ENVIRON HEALTH
J ENVIRON QUAL
J ENVIRON SCI HEALTH
J EUR TOXICOL
J EXP BOT
J FISH RES BOARD CAN
J FLA MED ASSOC
J FLOUR ANIM FEED MILLING
J FOOD HYG SOC JPN
SEE SHOKUHIN EISEIGAKU ZASSHI
J FOOD SCI
J FOOD SCI TECHNOL (MYSORE)
J FORENSIC SCI SOC
J GEN MICROBIOL
J HERED
J HYG CHEM SEE EISEI KAGAKU
J HYG EPIDEMIOL MICROBIOL IMMUNOL
J INDIAN ACAD FORENSIC SCI
J INDIAN SOC SOIL SCI
J INST ENG (INDIA)
J INVERTEBR PATHOL
J JPN ASSOC RURAL MED SEE
NIPPON NOSON IGAKKAI ZASSHI
J JPN OIL CHEM SOC SEE YUKAGAKU
J JPN OPHTHALMOL SEE NIPPON GANKA KIYO
J JPN OPHTHALMOL SOC SEE
NIPPON GANKA GAKKAI ZASSHI
J JPN SOC FOOD NUTR SEE EIYO TO SHOKURYO
J KANS ENTOMOL SOC
J KURUME MED ASSOC SEE
KURUME IGAKKAI ZASSHI
J LABELLED COMPOUNDS
J MAR RES
J MAR TECHNOL SOC
J MED
J MED CHEM
J MED ENTOMOL
J MED SOC TOHO UNIV SEE TOHO IGAKKAI ZASSHI
J MILK FOOD TECHNOL
J MISS STATE MED ASSOC
J N Y ENTOMOL SOC
J NAGOYA CITY UNIV MED ASSOC
SEE NAGOYA-SHIRITSU DAIGAKU IGAKKAI ZASSHI
J NATL CANCER INST
J NEUROCHEM
J NEUROPATHOL EXP NEUROL
J NIPPON MED SCH SEE NIPPON IKA DAIGAKU ZASSHI
J NUTR
J NUTR SCI VITAMINOL
J OCCUP MED
J PATHOL
J PEDIATR
J PEDIATR PRACT SEE SHONIKA SHINRYO
J PESTIC SCI
J PHARM PHARMACOL
J PHARM SCI
J PHARMACOL
J PHARMACOL EXP THER
J PHYS E
J PHYSIOL (LONDON)
J PHYSIOL SOC JPN SEE NIPPON
SEIRIGAKU ZASSHI
J PRAKT CHEM
J RADIOANAL CHEM
J RANGE MANAGE
J REPROD FERTIL
J RES PUNJAB AGRIC UNIV
J S AFR VET MED ASSOC
J S C MED ASSOC
J SCI FOOD AGRIC
J SCI IND RES
J SCI SOIL ANIM FERT JPN
SEE NIPPON DOJO HIRYOGAKU ZASSHI
J SOC DAIRY TECHNOL
J SOIL SCI
J STORED PROD RES
J SURG ONCOL
J TOXICOL ENVIRON HEALTH
J TROP MED HYG
J WASH ACAD SCI
J WATER POLLUT CONTROL FED
J WILDL MANAGE
J ZOO ANIM MED
J ZOOL
JARQ (JPN AGRIC RES Q)
JIKKEN DOBUTSU (EXP ANIM)
JNKVV RES J
JPN AGRIC RES Q SEE JARQ
JPN ANAL SEE BUNSEKI KAGAKU
JPN J APPL ENTOMOL ZOOL
SEE NIPPON OYO DOBUTSU KONCHU GAKKAI-SHI
JPN J CLIN MED SEE NIPPON RINSHO
JPN J CLIN OPHTHALMOL SEE RINSHO GANKA
JPN J ENDOCRINOL
SEE NIPPON NAIBUNPI GAKKAI ZASSHI
JPN J HYG SEE NIPPON EISEIGAKU ZASSHI
JPN J IND HEALTH SEE SANGYO IGAKU
JPN J IND HYG SEE RODO EISEI
JPN J LEG MED SEE NIPPON HOIGAKU ZASSHI
JPN J OPHTHALMOL SOC SEE NIPPON
GANKA GAKKAI ZASSHI
JPN J PHARMACOL SEE NIPPON YAKURIGAKU ZASSHI
JPN J PUBLIC HEALTH SEE NIPPON
KOSHU EISEI ZASSHI
JPN J ZOOTECH SCI SEE NIPPON
CHIKUSAN GAKKAI-HO
JPN MED J SEE NIPPON IJI SHINPO
JPN PESTIC INFORM
JPN PLANT PROTECT SEE SHOKUBUTSU BOEKI
JPN RADIOISOTPE ASSOC NEWS
SEE NIPPON HOSHASEI DOIGENSO KYOKAI NYUSU
JPN REV CLIN OPHTHALMOL SEE GANKA RINSHO IHO
JUGOSL INOSTR DOK ZAST RADU
KAGAKU TO SEIBUTSU
KANAGAWA IGAKUKAI ZASSHI
KEM IND
KEMIA-KEMI
KERTESZETIEGY KOZL
KHIG ZDRAVEOPAZ
KHIM IND (SOFIA)

KHIM SEL'SK KHOZ
KIEL MILCHWIRTSCH FORSCHUNGSBER
KISERL ORVOSTUD
KLIN WOCHENSCHR
KONGETSU NO NOYAKU (AGRIC CHEM MON)
KONSERVN OVOSHCHESUSH PROM
KUN CHUNG HSUEH PAO
KURUME IGAKKAI ZASSHI (J KURUME MED ASSOC)
KVASNY PRUM
KYOTO-SHI EISEI KENKYUSHO NENPO
LA AGRIC
LAB ANIM
LAB ANIM SCI
LAB DELO
LAB INVEST
LAB PRACT
LAEKARTIDNINGEN
LAIT
LANCET
LANDBAUFORSCH VOELKENRODE
LANDBOUWKD TIJDSCHR
LIFE SCI
LIMOSA
MADRAS AGRIC J
MAGY ALLATORV LAPJA
MAR BIOL
MAR POLLUT BULL
MATER ORG
MED BIOL SEE IGAKU TO SEIBUTSUGAKU
MED J AUST
MED KLIN (MUNICH)
MED LAV
MED MONATSSCHR
MED PARAZITOL PARAZIT BOLEZNI
MED PR
MED TREAT SEE IRYO
MED TRIAL TECH U
MED WELT
MED WEEK
MED WORLD NEWS
MED ZH UZB
MEDED FAC LANDBOUWWET RIJKSUNIV GENT
MEDICAMENTA
MEDICINA (BUENOS AIRES)
MFG CHEM AEROSOL NEWS
MICROB ECOL
MIE IGAKU (MIE MED SCI)
MIE MED SCI SEE MIE IGAKU
MIKROBIOL ZH (KIEV)
MIKROBIOLOGIYA (MOSCOW)
MIKROCHIM ACTA
MILCHWISSENSCHAFT
MINERVA MED
MINN MED
MINN UNIV AGRIC EXT SERV BULL
MINZOKU EISEI (HUM HYG)
MISS AGRIC FOREST EXP STN
MISS FARM RES
MITT BIOL BUNDESANST LAND-FORSTWIRTSCH BERLIN-DAHLEM
MITT DTSCH PHARM GES
MITT GEB LEBENSMITTELUNTERS HYG
MIZU SHORI GIJUTSU
MLJEKARSTVO
MOD KEMI
MOD VET PRACT
MOL GEN GENET
MOL PHARMACOL
MONATSH VETERINAERMED
MONATSSCHR KINDERHEILK
MONATSSCHR OHRENHEILK LARYNGO-RHINOL
MOSQ NEWS
MUNKAVEDELEM
MUTAT RES
MYSORE J AGRIC SCI
N ENGL J MED
N J AGRIC EXP STN BULL
N Y FISH GAME J
N Z J AGRIC RES
N Z J EXP AGRIC
N Z J SCI
N Z MED J
NACHRICHTENBL DTSCH PFLANZENSCHUTZDIENSTES (BRAUNSCHWEIG)
NACHRICHTENBL PFLANZENSCHUTZDIENST DDR
NAGOYA-SHIRITSU DAIGAKU IGAKKAI ZASSHI (J NAGOYA CITY UNIV MED ASS)
NAHRUNG
NARA IGAKKAI ZASSHI
NAT HIST
NATL DEF MED J SEE BOEI EISEI
NATURE (LONDON)
NATURWISSENSCHAFTEN
NAUCHNI TR VISSH MED INST SOFIA
NAUNYN-SCHMIEDEBERGS ARCH PHARMAKOL
NED TIJDSCHR GENEESKD
NEMATOLOGICA
NETH J MED
NEUROLOGY
NEUROPATOL POL
NEW SCI
NIPPON CHIKUSAN GAKKAI-HO (JPN J ZOOTECH SCI)
NIPPON DOJO-HIRYOGAKU ZASSHI (J SCI SOIL ANIM FERT JPN)
NIPPON EISEIGAKU ZASSHI (JPN J HYG)
NIPPON GANGAKKAI KIJI (PROC JPN CANCER ASSOC)
NIPPON GANKA GAKKAI ZASSHI (J JPN OPHTHALMOL SOC)
NIPPON GANKA KIYO (J JPN OPHTHALMOL)
NIPPON HOIGAKU ZASSHI (JPN J LEG MED)
NIPPON IJI SHINPO (JPN MED J)
NIPPON IKA DAIGAKU ZASSHI (J NIPPON MED SCH)
NIPPON KOGYO EISEI GAKKAI NENKA
NIPPON KOSHU EISEI ZASSHI (JPN J PUBLIC HEALTH)
NIPPON NAIBUMPI GAKKAI ZASSHI (JPN J ENDOCRINOL)
NIPPON NAIKAGAKKAI ZASSHI
NIPPON NOGEI KAGAKU KAISHI (J AGRIC CHEM SOC JPN)
NIPPON NOSON IGAKKAI ZASSHI (J JPN ASSOC RURAL MED)
NIPPON OYO DOBUTSU KONCHU GAKKAI-SHI (JPN J APPL ENTOMOL ZOOL)
NIPPON RINSHO (JPN CLIN MED)
NIPPON SEIRIGAKU ZASSHI (J PHYSIOL SOC JPN)
NIPPON SUISAN GAKKAISHI
NIPPON YAKURIGAKU ZASSHI (JPN J PHARMACOL)
NO TO SHINKEI (BRAIN NERVE)
NOGYO GIJUTSU (TOKYO) (J AGRIC SCI (TOKYO))
NOGYO OYOBI ENGEI
NOR VET-TIDSSKR
NORD VET MED
NOYAKU KENSASHO HOKOKU SEE BULL AGRIC CHEM INSP STN
NUOVI ANN IG MICROBIOL
NURS MIRROR

NUTR REP INT
OCCUP HEALTH NURSING
OCEANS
OECOL PLANT
OHIO AGRIC RES DEV CENT RES CIRC
OIKOS
OKAYAMA IGAKKAI ZASSHI (J OKAYAMA MED SOC)
OKAYAMA-KEN EISEI KENKYUSHO NENPO
(ANNU REP OKAYAMA PREFECT PUBLIC HEALTH LAB)
ORV METIL
OYO-YAKURI (PHARMACOMETRICS)
PAK J SCI IND RES
PAN AM HEALTH ORGAN SCI PUB
PANS (PESTIC ARTIC NEWS SUMM)
PAP PUU
PATOL POL
PEDIATR POL
PEDIATR RES
PEDIATRICS
PEDIATRIYA (MOSCOW)
PEDOBIOLOGIA
PEST CONTROL
PESTIC BIOCHEM PHYSIOL
PESTIC MONIT J
PESTIC SCI
PESTIC TECH SEE NOYAKU SEISAN GIJUTSU
PESTICIDES
PESTICIDES (TOKYO) SEE NOYAKU
PFLANZENARZT
PFLANZENSCHUTZ-NACHR (AM ED)
PHARM PRAX
PHARMACOL RES COMMUN
PHARMACOLOGIST
PHARMACOLOGY
PHARMACOMETRICS SEE OYO YAKURI
PHARMACY SEE YAKUGAKU
PHARMAZIE
PHYCOLOGIA
PHYSIOL PLANT
PHYSIOLOGIST
PHYTOCHEMISTRY
PHYTOMA
PHYTOPARASITICA
PHYTOPATHOLOGY
PLANT DIS REP
PLANT PHYSIOL
PLANT PROTECT SEE SHOKUBUTSU BOEKI
PLANT SOIL
POL J PHARMACOL PHARM
POL J SOIL SCI
POL TYG LEK
POSTEPY MIKROBIOL
POSTEPY NAUK ROLN
POSTGRAD MED J
POTATO RES
POULT SCI
POUMON COEUR
POZNAN TOW PRZYJ NAUK PR KOM
PR NAUK INST OCHR ROSL
PRAC LEK
PRACTITIONER
PRAKT TIERARZT
PRAXIS
PREV MED
PRIRODA (SOFIA)
PROBL ANAL KHIM
PROBL ENDOKRINOL
PROC AM ASSOC CANCER RES
PROC ANNU CALIF WEED CONF
PROC ANNU CONF SOUTHEAST ASSOC GAME FISH COMM
PROC ANNU MEET N J MOSQ EXTERM ASSOC
PROC ARKANSAS ACAD SCI
PROC ENTOMOL SOC ONT
PROC INDIANA ACAD SCI
PROC IOWA ACAD SCI
PROC KANSAI PLANT PROTECT SOC
SEE KANSAI BYOCHUGAI KENKUKAI-HO
PROC KANTO TOSAN PLANT PROTECT SOC
SEE KANTO TOSAN BYOGAICHU KENKYUKAI NENPO
PROC N CENT BR ENTOMOL SOC AM
PROC N DAK ACAD SCI
PROC NATL ACAD SCI INDIA
PROC NATL ACAD SCI USA
PROC NORTHEAST WEED SCI SOC
PROC PA ACAD SCI
PROC PAP ANNU CONF CAL MOSQ CONTR
PROC R SOC LONDON
PROC R SOC MED
PROC S D ACAD SCI
PROC S WEED SCI SOC
PROC SOC ANAL CHEM
PROC SOC EXP BIOL MED
PROC WEST SOC WEED SCI
PROGR AGRIC ARIZONA
PROGR CHEM CHEM IND SEE HWAHAK KWA
KONGUP UI CHINBO
PRUM POTRAVIN
PSZCZELNICZE ZESZ NAUK
PUBLIC HEALTH
PUBLIC HEALTH INFORM SEE KOSHU EISEI JOHO
PURE APPL CHEM
PYRETHRUM POST
QUAL PLANT PLANT FOODS HUM NUTR
RADIOCHEM RADIOANAL LETT
RASS CHIM
RAST ZASHT
REC MED VET ECOLE ALFORT
RECHERCHE
RECL MED VET
REFUAH VET
REP HOKKAIDO INST PUBLIC HEALTH
SEE HOKKAIDORITSU EISEI KENKYU SHOHO
REP TOKYO PUBLIC HEALTH STUD
SEE TOKYO-TO EISEI-KYOKU GAKKAI-SHI
RES COMMUN CHEM PATHOL PHARMACOL
RES IND
RES LIFE SCI
RES VET SCI
RESIDUE REV
REV AGRIC
REV AGROQUIM TECNOL ALIMENT
REV BRAS CLIN TER
REV CHIM (BUCHAREST)
REV CUBANA FARM
REV ELECTROENCEPHALOGR NEUROPHYSIOL CLIN
REV FARM BIOQUIM UNIV SAO PAULO
REV INST ADOLFO LUTZ
REV INT OCEANOGR MED
REV MED-CHIR
REV MED VET (TOULOUSE)
REV ROUM BIOCHIM
REV ROUM EMBRYOL
REV ROUM NEUROL
REV SANIT HIG PUBLICA

REV VET VENEZ
R I MED J
RICE J
RINSHO GANKA (JAP J CLIN OPHTHALMOL)
RINSHO NOHA (CLIN ELECTROENCEPHALOGR)
RINSHO SHINKEIGAKU (CLIN NEUROL)
RIV CLIN TOSSICOL
ROCZN PANSTW ZAKL HIG
RODO EISEI (JPN J IND HYG)
RODO KAGAKU
RYBN KHOZ (MOSCOW)
S AFR MED J
SAKH PROMST
SALUD PUB MEX
SANGYO IGAKU (IND MED)
SANKYO KENKYUSHO NENPO (ANNU REP SANKYO RES LAB)
SCAND J WORK ENVIRON HEALTH
SCHRIFTENR VER WASSER- BODEN- LUFTHYG BERLIN-DAHLEM
SCHWEIZ MED WOCHENSCHR
SCI AGRIC BOHEMOSLOV
SCI AM
SCI FOODS SEE SHOKURYO NO KAGAKU
SCI NEWS
SCI PEST CONTROL SEE BOCHU KAGAKU
SCI TOTAL ENVIRON
SCIENCE
SCIENCE (TOKYO) SEE KAGAKU (TOKYO)
SCR MED FAC MED UNIV BRUN PURKYNIANAE
SEA SECRETS
SEARCH
SELSKOSTOP NAUKA
SENTEN IJO (CONGENITAL ANOMALIES)
SHOKUBUTSU BOEKI (PLANT PROTECT)
SHOKUHIN EISEIGAKU ZASSHI (J FOOD HYG SOC JPN)
SHOKURYO NO KAGAKU (SCI FOODS)
SHONIKA SHINRYO (J PEDIATR PRACT)
SOAP COSMET CHEM SPEC
SOGO RINSHO (CLIN ALL-AROUND)
SOIL BIOCHEM
SOIL BIOL BIOCHEM
SOIL SCI
SOIL SCI PLANT NUTR (TOKYO)
SOIL SCI SOC AM PROC
SOOBSHCH AKAD NAUK GRUZ SSR
SOUTHEAST ASIAN J TROP MED
SOUTHWEST VET
SOV GENET (TRANS OF GENETIKA)
SOV MED
SOV SOIL SCI
STAERKE
STRAHLENTHERAPIE
STUD CERCET BIOL SER ZOOL
STUD CERCET CHIM
SUCR BELGE
SUD-MED EKSPERT
SUESSWAREN
SULZER TECH REV
SYMP BIOL HUNG
TABAK (MOSCOW)
TAI-WAN I HSUEH HUI ISA CHIH SEE J FORMOSAN MED ASSOC
TALANTA
TEC MOLITORIA
TECHNOL REV
TER ARKH
TERATOLOGY
TETHYS
TETRAHEDRON
TETRAHEDRON LETT
TEX J SCI
THERAPIE
TIDSSKR NOR LAEGEFOREN
TIDSSKR PLANTEAVL
TIERAERZTL UMSCH
TIJDSCHR DIERGENEESKD
TIJDSCHR SOC GENEESKD
TNO NIEUWS
TOR HEALTH WORKSHOP CONF PROC
TOB INT SEE TOB SCI
TOB SCI
TOHO IGAKKAI ZASSHI (J MED SOC TOHO UNIV)
TOHOKU J EXP MED
TOKYO-TORITSU EISEI KENKYUSHO KENKYU NENPO (ANNU REP TOKYO METROP RES LAB PUBLIC HEALTH)
TOXICOL APPL PHARMACOL
TOXICOLOGY
TR STAVROP SKH INST
TR VSES NAUCH-ISSLED INST VET
TRANS AM FISH SOC
TRANS ASAE (AM SOC AGRIC ENG)
TRANS ILL STATE ACAD SCI REP
TRANS R SOC TROP MED HYG
TRANS SOC PATHOL JPN SEE NIPPON BYORI GAKKAI KAISHI
TRAV SOC PHARM MONTPELLIER
TRIB CEREDEAU
TROP MED
TSITOL GENET
TSITOLOGIYA
TURRIALBA
UGESKR LAEG
UKR BIOKHIM ZH
UKR KHIM ZH
UMWELT
UZB KHIM ZH
VAR FOEDA
VERH DTSCH GES INN MED
VESTN AKAD MED NAUK SSSR
VESTN DERMATOL VENEROL
VESTN SKH NAUKI KAZ
VET CLIN NORTH AM
VET MED
VET-MED NAUKI
VET MED SMALL ANIM CLIN
VET REC
VETERINARIA (SARAJEVO)
VETERINARIYA (MOSCOW)
VIRCHOWS ARCH
VISSH SELSKOSTOP INST V KOLAROV
VOD HOSPOD B
VOEDINGSMIDDELENTECHNOLOGIE
VOENNO-MED ZH
VOJNOSANIT PREGL
VOM WASSER
VOPR MED KHIM
VOPR ONKOL
VOPR PITAN
VRACH DELO
WATER AIR SOIL POLLUT
WATER RES
WATER RESOUR BULL

WATER SEWAGE WORKS
WEED RES
WEED SCI
WEST INDIAN MED J
WHO CHRONICLE
WHO TECH REP SER
WIAD LEK
WIAD PARAZYTOL
WIEN KLIN WOCHENSCHR
WIEN MED WOCHENSCHR
WIEN TIERAERZTL MONATSSCHR
WORLD REV NUTR DIET
XENOBIOTICA
YAKUGAKU ZASSHI (J PHARM SOC JPN)
YAKUNU KOHO (PHARM GAZ)
YAMANASHI KENRITSU EISEI KENKYUSHO NENPO
(ANNU REP YAMANASHI PREFECT INST PUBLIC HEALTH
YOSUI TO HAISUI (WATER WASTE)
YUKAGAKU (J JPN OIL CHEM SOC)
Z AERZTL FORTBILD
Z ALLG MIKROBIOL
Z ALLGEMEINMED
Z ANGEW ENTOMOL
Z ANGEW ZOOL
Z CHEM
Z ERKR ATMUNGSORGANE
Z ERNAEHRUNGSWISS
Z GESAMTE HYG IHRE GRENZGEB
Z GESAMTE INN MED IHRE GRENZGEB
Z JAGDWISSENSCH
Z KREBSFORSCH
Z LEBENSM-UNTERS-FORSCH
Z MED LABORTECH
Z MIKROSK-ANAT FORSCH
Z NATURFORSCH
Z PARASITENKD
Z PFLANZENERNAEHR
Z PFLANZENKR PFLANZENSCHUTZ
Z RECHTSMED
Z THER
Z WASSER ABWASSER FORSCH
ZASHCH RAST (MOSCOW)
ZASSO KENKYU (WEED RES (TOKYO))
ZAST BILJA
ZAST MATER
ZAVOD LAB
ZDRAVOOKHR TADZH
ZDRAVOOKHRANENIE
ZENTRALBL ALLG PATHOL PATHOL ANAT
ZENTRALBL ARBEITSMED ARBEITSSCH
ZENTRALBL BAKTERIOL PARASITENKDE
INFEKTIONSKR HYG
ZENTRALBL VETERINAERMED
ZESZ NAUK AKAD ROLN SZCZECINIE
ZESZ NAUK WYZSZ SZK ROLN WROCLAWIU ROLN
ZH ANAL KHIM
ZH EKSP KLIN MED
ZH MIKROBIOL EPIDEMIOL IMMUNOBIOL
ZH NEVROPATOL PSIKHIAT IM S S KORSAKOVA
ZH PRIKL KHIM (LENINGRAD)
ZH USHN NOS GORL BOLEZN
ZH VSES KHIM OVA
ZHIVOTNOVODSTVO
ZOOL ZH
ZOOPROFILASSI
ZUCKER

77-0001. Robins, R. K. (ICN Pharmaceuticals, Inc., Nucleic Acid Res. Inst., Irvine, CA 92664). **Nucleosides and nucleotides: past, present, and future.** *Ann. NY Acad. Sci.* 255: 597-610; 1975. (82 references)

The medical uses of nueleosides and nucleotides are reviewed with a look into possible future uses of these chemicals in efforts to benefit mankind. One interesting future application of nucleosides and nucleotides lies in the area of insecticides. With environmental pollution under such careful scrutiny, the search is being carefully made for potent biodegradable insecticides. An insecticidal exotoxin produced by *Bacillus thuringiensis* was recently prepared and the structure established. This chemical is a trisaccharide phosphate derivative of adenosine. It is of interest that anthelmycin is an effective housefly larvicide and tubercidin is an effective chemosterilant when ingested orally by the common housefly.

77-0002. Sanders, H. J. (Chem. Eng. News, Washington, DC). **New weapons against insects.** *Chem. Eng. News* 53(30): 18-31; 1975.

Information from the World Health Organization states that about one third of the world's food crop is consumed or destroyed by insects. These insects not only eat our food, they also destroy livestock, timber, and fiber crops, and transmit disease. Even so, major restrictions have already been enacted against DDT, aldrin, and dieldrin, and are threatening the continued use of chlordane and heptachlor. Increasingly rigid safety standards have caused the length of time and cost of research and development in this field to climb very fast. If the market for a particular item is expected to be small, the effort needed to produce the item will necessitate stopping its development. Recent developments in the areas of organophosphorus insecticides, carbamate insecticides, pyrethroids, integrated pest control, predators and parasites, insect-resistant crops, chitin inhibitors, sex attractants, bacterial insecticides, and viral insecticides are reviewed. Although some insect populations appear to be declining, others are increasing and the need for further work continues.

77-0003. Rich, L. A. (Environ. Inform. Cent., New York, NY 10017). **Where do environmental laws and regulations stand today?** *Chem. Engn. (London)* 83(22): 9-17; 1976.

Developments in federal legislation relating to the field of environmental protection are reviewed. The act which received the most attention during the year 1976 was the Federal Water Pollution Control Act of 1972. While effluent guidelines and standards were being produced for various industries, other industries brought suit against Russell Train and the EPA, and succeeded in revoking some legislation. In particular the organic chemicals industries saw much legislation suspended. The year saw several states in substantial compliance with implementing the requirements of the Clean Air Act of 1970. The Toxic Substances Control Act, passed by the House of Representatives in August of 1976, will affect the chemical products industries significantly as it grants EPA the authority to require industry to test for toxic substances at industry's expense, it gives EPA the authority to require industry to give EPA a 90-day notice prior to commencement of manufacture of toxic substances, and EPA has regulatory jurisdiction over specific substances.

77-0004. Graham-Bryce, I. J. (Dept. Insect. Fungicides, Rothamsted Exp. Stn., Harpenden, Herts., England). **Crop protection: present achievement and future challenge.** *Chem. Ind. (London)* 13: 545-553; 1976. (41 references)

Some present achievements in crop protection and possible future developments are considered against the broad background of international and national trends and influences. Insect and disease control on the growing crop are emphasized. Modern methods of crop protection have included the use of chemical pesticides and of resistant crop strains, and these steps have had impressive results. However, the development of unwanted side effects, the lack of chemicals available for certain specific damaging insects, and the spread of these chemicals to nontarget as well as target organisms are some of the problems associated with pesticide usage. The use of organochlorines, the organophosphates, and the carbamates, all of which act on the nervous system, poses disadvantages in terms of selectivity and the risks of developing resistance. The control of insect behavior by sex pheromones is a new field as yet and much work in needed to fully evaluate the possibilities.

77-0005. Potter, C. **Paradise poisoned?** *Chem. Ind. (London)* 20: 824-826; 1974.

Many chemicals produced and used in the modern world present a hazard to humans and it is very difficult to establish how serious the hazard is. Even with stringent precautions, damage can be produced in ways that have been foreseen or cannot be exactly predicted. No matter how exhaustive the tests, not every possible effect of a chemical can be foreseen. After some of the hazards become known, it must be decided whether the benefits to be derived from the use of the chemical outweigh the deleterious effects. The establishment of a data bank for information regarding chemicals released into the environment is recommended. This referral system would consist of a directory file of relevant sources of information, data collections, and centers of expertise. Chemorecords would assemble data on the substances, their properties, production, uses, handling, environmental involvement, toxicology, and control. Georecords would note the places and the measurements made there. Biorecords would concern man and other animals and their ecological interactions.

77-0006. Adams, R. S., Jr. (Soil Sci. Dep., Univ. Minnesota, Rochester, MN). **Pesticides, food, and health.** *Crops Soils* 29(1): 5-7; 1976.

The confidence of the American public in the quality of their food is at an all-time low. The introduction of food additives during food processing and the contamination from pesticides as a result of pest control in the fields are common areas for concern. A more realistic view of environmental chemicals is needed. The banning of relatively mild synthetic chemicals while virtually ignoring the more potent chemicals which are natural parts of our food does not make much sense. It is recognized that if every cancer causing substance always initiated cancer when it contacted a susceptible tissue, it is likely that no one would reach the age of 50. It is essential that a tolerance level be established for each of the risks facing the consumers, including both natural food toxins and synthetic pesticides. The tolerance levels must have enough credibility so that they can be made more rigorous or less rigorous as new circumstances arise and as new information becomes available.

77-0007. Falk, H. L. (Natl. Inst. Environ. Health Sci., Research Triangle Park, NC 27709). **Introduction to conference on human health effects of new approaches to insect pest control.** *Environ. Health Perspect.* 14:1-2; 1976.

This conference was designed to review current knowledge in the field of pest control, emphasizing new approaches to the problem. Some of the so-called new approaches really are not new, but were set aside when DDT came into use. Others of these chemical groups are new and are discussed in this conference with particular emphasis on their chemical structures and the implications these have toward human health. Methods to monitor and assess toxic environmental levels of these compounds must be quite different from conventional methods in that only a few thousand molecules will be needed to have an effect on the target insect. Such methods will be discussed in the conference. Sex attractants, juvenile hormones, and natural pest control are all considered.

77-0008. Hunter, R. C. (Ag-Organics Dep., Dow Chem. Co., Midland, MI 48640). **Organotin compounds and their use for insect and mite control.** *Environ. Health Perspect.* 14: 47-50; 1976.

The biological activity of organotin compounds is briefly reviewed. The triaryltins have activity as antifoulants, bactericides, molluscicides, algicides, anthelmintics, fungicides, insect antifeedants, acaricides, chemosterilants, and insecticides. Their relatively low phytotoxicity enables these compounds to be used for plant protection. The open-chain trialkyltins have activity as insecticides, fungicides, and rodent repellents. However, they are not useful for plant protection as they are generally phytotoxic and are ineffective as plant fungicides in greenhouse and field tests, perhaps due to their relatively high volatility. Several closed-chain trialkyltin compounds have biological activity against arthropod pests of plants, particularly as antifeedants and sterilants. Plictran miticide is used as a model to indicate the chemistry and potential performance, phytotoxicity, residues, limitations of usage, environmental acceptability, and use patterns for products containing similar organotin compounds.

77-0009. Hollingworth, R. M. (Dep. Entomol., Purdue Univ., West Lafayette, IN 47907). **Chemistry, biological activity, and uses of formamidine pesticides.** *Environ. Health Perspect.* 14: 57-69; 1976. (77 references)

This paper reviews the historical development, properties, structures, uses, and chemistry of formamidines, with emphasis on chlordimeform, *N'*-4-chloro- *o*-tolyl- *N,N*-dimethylformamidine, and amitraz, 1,3-di-(2,4-dimethylphenylimino) -2- methyl-2-azapropane. These chemicals are toxic to spider mites, ticks, and certain insects, and they are very effective against juvenile and resistant forms of these organisms. Their toxic action includes direct lethality, excitant-repellant behavioral effects, and chemosterilization. They are of low hazard for nontarget species with the significant exception of predaceous mites. Structure-activity relations, synthetic pathways, isomerism, and configuration are reviewed. Their chemical and environmental stability are considered. The possible activation of chlordimeform by *N*-demethylation in vivo is a significant feature of the metabolism and toxicity of these agents. Evidence for that theory is presented with the cattle tick, but in other species it appears that *N*-demethylation is neither a strong activation nor a detoxication reaction.

77-0010. March, R. B. (Dep. Etomol., Univ. California, Riverside, CA 92502). **Properties and actions of bridged diphenyl acaricides.** *Environ. Health Perspect.* 14: 83-91; 1976. (64 references)

Properties and actions of bridged diphenyl acaricides are reviewed. The bridged diphenyl acaricides are more or less structurally related to DDT. They have remarkable properties of specificity, are primarily toxic to phytophagous mites, and are of very low toxicity to most nontarget species, which includes insects, fish, birds, and mammals. Many important facets of their broad mode of action are understood. However, very little is known about their primary mode of action or the underlying bases of their specificities. In many ways they are model compounds for integrated control and pest management activities.

77-0011. Knowles, C. O. (Dep. Entomol., Univ. Missouri, Columbia, MO 65201). **Chemistry and toxicology of quinoxaline, organotin, organofluorine, and formamidine acaricides.** *Environ. Health Perspect.* 14: 93-102; 1976. (83 references)

This paper reviews existing data from studies of the chemistry and toxicology of the quinoxaline, organotin, organofluorine, and formamidine compounds. Studies indicated that cyclic dithiocarbonates usually had higher initial toxicity to spider mites than trithiocarbonates.

Oxythioquinox has a broad spectrum of miticidal activity and is active against some insects and fungi. Oxythioquinox has a relatively low acute toxicity. The three organotins that possess appreciable acaricidal activity are Plictran, Vendex, and R-28627. Plictran is the only organotin currently in use for mite control. Four different types of organofluorine miticides are represented by fluenethyl, Nissol, fenazaflor, and R-10044. There are five types of formamidines of current commercial interest as acaricides and insecticides. Chlordimeform is the forerunner of this class of compounds. Arylthioformamidines are the most recent addition to this group.

77-0012. Soloway, S. B. (Shell Development Co., Modesto, CA 95352). **Naturally occurring insecticides.** *Environ. Health Perspect.* 14: 109-117; 1976. (7 references)

Various aspects of naturally occurring insecticides are reviewed. These insecticides include nicotine alkaloid, nicotine sulfate, rotenone (cube), rotenone (derris), hellebore, ryania, sabadilla, and pyrethrum. Topics considered in this review include: chemical nature of the compounds, the relation of insecticidal activity to chemical structure, the occurrence, production and utilization of these compounds, registered uses, metabolism, and insect and mammalian toxicity. In general natural insecticides are of low mammalian toxicity, both oral and dermal. However, they are mixtures of active and inactive components and their low content of active ingredients on a crop yield basis is viewed as a disadvantage. This points to a high unit cost. The finding of natural insecticides in some cases has led to production of several synthetic compounds which are similar in nature and of greater benefit in crop production.

77-0013. Siddall, J. B. (Zoecon Corp. Res. Lab., Palo Alto, CA 94304). **Insect growth regulators and insect control: A critical appraisal.** *Environ. Health Perspect.* 14: 119-126; 1976. (39 references)

Current knowledge on insect growth regulators in relation to insect control is reviewed. Such regulators of the juvenile hormone type change physiological processes essential to insect development and seem to act specifically on insects. In insects there are three natural juvenile hormones identified thus far. These have not been found in other organisms. The future use of antagonists or inhibitors of hormone synthesis may be technically possible as an advantageous extension of pest control by these insect growth regulators. A study of the properties, metabolism, toxicology, and uses of methoprene, the most commercially advanced of these chemicals, shows it is environmentally acceptable and toxicologically innocuous. Residue levels and their measurement in the ppb region have allowed exemption from the requirement of tolerances in the Environmental Protection Agency registered use of methoprene for mosquito control. It is allowed for use in controlling manure breeding flies through a cattle feed supplement. Human health effects of this chemical appear to be purely beneficial, but further advances through new regulators seem unlikely without major changes in regulatory and legislative policy.

77-0014. Wright, J. E. (Vet. Toxicol. Entomol. Res. Lab., ARS, USDA, College Station, TX 77840). **Environmental and toxicologic aspects of insect growth regulators.** *Environ. Health Perspect.* 14: 127-132; 1976. (59 references)

Environmental and toxicologic aspects of insect growth regulators are reviewed. These compounds act to interrupt development and thus cause death or reproductive failure of insects exposed at a specific time in their life cycles. Metabolism in soils, plants, insects, and animals suggests that these chemicals undergo rapid degradation and metabolism to innocuous metabolites. No significant effects against various species were found in the toxicological testing for registration of methoprene. Toxicological evaluations in swine, sheep, hamsters, rats, dogs, rabbits, guinea pigs, and cattle revealed no clinical signs of toxicosis. Teratological studies in swine, sheep, hamsters, rats, and rabbits also showed no observable effects in these animals at the dose levels tested. Because of these properties of the insect growth regulators it is hard to visualize the occurrence of significant environmental problems, especially with the juvenile hormones. As they are rapidly metabolized by both plants and animals, accrued harmful effects may be difficult to ascertain. For greatest effectiveness the compounds are used against individual species at given times in their life cycles.

77-0015. Knipling, E. F. (Agric. Res. Serv., Natl. Agric. Library, Beltsville, MD 20705). **Role of phermones and kairmones for insect suppression systems and their possible health and environmental impacts.** *Environ. Health Perspect.* 14: 145-152; 1976. (41 references)

This paper reviews current knowledge regarding the role of pheromones and kairomones in insect suppression systems and the possible health and environmental impacts. Pheromones are produced by insects as a chemical communications system to aid in reproduction. These chemical attractants have been synthesized for various insect pests including: boll weevil, gypsy moth, codling moth, tobacco budworm, European corn borer, and several bark beetles. None of the synthetic chemicals thus far developed has been of use for insect control. However, they should offer aids for insect control and detection in the future. Insect trapping systems employing the pheromones are underway and air permeation techniques to disrupt insect reproduction are being studied. Pheromones are highly species-specific and not likely to be a hazard to nontarget organisms. Toxicologic studies show they are low in mammalian, bird, and fish toxicity, but the data is not yet adequate for registration purposes. Kairomones, another new class of compounds, are involved in the detection of hosts or prey by insect parasites and predators. Kairomones may be useful in manipulating

natural or released biological agents to offer more effective biological control of insect pests.

77-0016. Engler, R.; Rogoff, M. H. (Environ. Protect. Ag., Off. Pestic. Programs, Registration Div., Washington, D. C. 20460). **Entomopathogens: ecological manipulation of natural associations.** *Environ. Health Perspect.* 14: 153-159; 1976. (18 references)

The ecological manipulation of natural associations by entomopathogens is reviewed. Advantages of these pathogens include the fact that they are more specific then chemical pesticides, have no harmful effect on man, other vertebrates or the environemnt, and there is less change of developing resistance. Disadvantages include the fact that more knowledge of the biology and interactions of pest and pathogen are needed than is true for chemical pesticides and the usually narrow host spectrum inhibits commercial development of the pathogen and may affect efficacy in complex pest situations. Viability is also a problem. The field of microbial pesticides offers a unique area for prognostic research in the pesticide world. Baculoviruses, for example, are already being researched, developed, and registered so that efforts in the area of viral pesticides may be coordinated and the viruses produced can be developed and safely used as pesticides. Similarly coordinated programs must be developed for other microbial pest control agents.

77-0017. Smith, R. F.; Calvert, D. J. (Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720). **Health-related aspects of integrated pest management.** *Environ. Health Perspect.* 14: 185-191; 1976. (14 references)

General aspects of integrated pest management, its significance in crop protection, and problems associated with establishing this approach are reviewed. A fundamental concept in integrated pest management is the importance of establishing realistic economic injury levels for a particular pest on a given crop. These levels are used to determine the need for control actions against that particular pest. The objective is to produce the optimum crop yield of high quality at minimum cost, considering the ecological and sociological constraints in that particular agroecosystem and the long-term preservation of the environment. Implications for human health of current pesticide practices in Central America are examined in order to illustrate major problems associated with the injudicious use of insecticides. These problems could be mitigated through the efforts and cooperation of a multidisciplinary team of scientists and technical people in the medical and agricultural sciences. Problems associated with developing integrated pest control systems in developing countries are discussed. The FAO/UNEP Global Programme is reviewed.

77-0018. Morrison, A. B. (Health Protect. Br., Health Welfare Canada, Ottawa K1A OL2, Ontario, Canada). **Food safety in the seventies.** *J. Milk Food Technol.* 39(3): 218-224; 1976.

There is a growing concern about the safety of foods available to the public. This concern continues to grow because the public is becoming increasingly well-informed about the adequacy of safety measures, because a vigorous industry is concerned about economic costs of food safety procedures, and because a a regulatory agency, the Health Protection Branch, is endeavoring to ensure the safety at all times of all foods which are available to Canadians. Requests for the use of specific chemicals in the growing, processing or storing of food necessitate the establishment of specific limits for these chemicals which are allowable without risk to the public. The class of pesticides, bis-dithiocarbamates, is used as an example of carcinogen production during plant metabolism of fungicides. The finding of carcinogenic metabolites from ethylenebisdithiocarbamate fungicides led to programs designed to study the uses of such fungicides on food crops, to establish permitted levels of their residues in foods, and to develop measures to control metabolite residues in processed fruits and vegetables. In all such questions the acceptability of risk can only be obtained at good estimate when the risk to the consumer and the compensating benefits are adequately evaluated.

77-0019. Brunnemann, K. D.; Hoffmann, D. (Naylor Dana Inst. Disease Prevent., Am. Health Foundation, Valhalla, NY 10595). **Analysis of polynuclear aromatic hydrocarbons in the respiratory environment.** *IN: Carcinogenesis–a comprehensive survey. Vol. 1. Polynuclear aromatic hydrocarbons: chemistry, metabolism, and carcinogenesis.* Ed. by R. Freudenthal and P.W. Jones, Raven Press, NY, 1976, pp. 283-297. (26 references)

An analysis was made of polynuclear aromatic hydrocarbons in cigarette smoke. Solvent distribution resulted in a subfraction (BIh) which amounted to about 0.09% of the dry tar and in which the polynuclear aromatic hydrocarbons (PAH) were highly enriched. Column chromatography of the BIh gave 80 subfractions, all of which were individually tested as tumor initiators on mouse skin. The results showed significant activity for the fractions BIh 56-66 and others. The fraction BIh 56-66 contained residues of chlorinated hydrocarbon insecticides such as DDD (TDE), *o,p'*-DDD, DDT, *o,p'*-DDT, DDM (DDD-HCl), DDE (DDT-HCl), and *trans*-4,4'-dichlorostilbene, as identified through chromatography on Sephadex LH-20, countercurrent distribution, and gas and high-pressure liquid chromatography. This identification was primarily achieved by UV spectrometry and retention times in GLC and HPLC systems with supporting data from mass spectrometry.

77-0020. Helle, E.; Olsson, M.; Jensen, S. (Dep. Zool., Univ. Oulu, SF-90 100 Oulu, Finland). **DDT and PCB levels and reproduction in Ringel Seal from the Bothnian Bay.** *Ambio* 5(4): 188-189; 1976. (19 references)

Forty female Ringel Seals (*Pusa hispida* Schreb) of reproductive age were collected in Finland to study the reproductive success of these animals in relation to the levels of DDT and PCB in their environment. In the Bothnian Bay, from which these seals were taken, only 27% of mature females were pregnant, whereas the corresponding figures for the same species in the Choska inlet and the Ochotskan Sea were 62.5 and 85-90%, resp. Significantly higher levels of both DDT and PCB were found in the non-pregnant females as compared to those who were pregnant. About half of the non-pregnant population showed evidence of implantation having occurred, followed by either resorption or abortion. Levels of DDT in extractable fat of blubber in non-pregnant seals and in pregnant seals were 130 and 75 mg/kg, resp. Corresponding levels of PCBs were 77 and 56 mg/kg, resp. The results of this study, when compared with those on California sea lions, suggest that PCB and not DDT substances were responsible for the perturbation of reproduction in these seals.

77-0021. Kuthan, A.; Javorska, T. (Ustred. Kontrol. Skusob. Ustav Pol'nohospodar., Bratislava, Czechoslovakia). **Dynamika rezidui dinoseb-acetatu v pode.** [**Dynamics of dinoseb acetate residues in the soil.**] *Agrochemia* 15(6): 175-177; 1975. (8 references) (Slovak)

Spring barley and alfalfa were treated with Aretit (dinoseb acetate), Dinoseb AC, or Laseb 20 (dinoseb). On the 1st day after treatment, residues of Aretit (0.90 mg/kg dry soil), Dinoseb AC (1.68 mg/kg) and Laseb 20 (1.18 mg/kg) were detected in the 0-15 cm soil layer. During the first day after treatment, residue levels in this layer were increased due to washing off from the plants, and decreased due to natural degradation and washing down into a lower soil layer. Residue levels in the 0-15 cm soil layer gradually decreased after the 1st day: respective levels for Aretit and Dinoseb AC were 0.84 and 1.60 mg/kg on the 7th day, 0.72 and 0.94 mg/kg on the 14th day, 0.52 and 0.35 mg/kg on the 24th day, and less than 0.1 mg/kg, the lower limit of the sensitivity of the analytical method used, for both herbicides on the 34th day. The Laseb 20 level on the 34th day was also less than 0.1 mg/kg. In the 15-30 cm soil layer, residues were detected on the 7th day (0.66 mg/kg Aretit and 0.76 mg/kg Dinoseb AC) and reached a maximum on the 14th day (0.74 mg/kg Aretit and 0.82 mg/kg Dinoseb AC). Thus herbicides on a dinoseb acetate base can wash down into the lower layers of the soil, especially during the first days after crop treatment. Levels in the 15-30 cm layer declined to 0.48 mg/kg Aretit and 0.40 mg/kg Dinoseb AC on the 24th day, and less than 0.1 mg/kg of both herbicides on the 34th day. The Laseb 20 level in this soil layer was 0.50 mg/kg on the 24th day and also less than 0.1 mg/kg on the 34th day. These results indicate that there is no essential difference between the movement and the decomposition period of dinoseb and dinoseb acetate residues in the soil.

77-0022. Smith, A. E.; Hayden, B. J. (Res. Stn., Agric. Canada., Regina, Saskatchewan, Canada S4P 3A2). **Field persistence studies with eight herbicides commonly used in Saskatchewan.** *Can. J. Plant Sci.* 56(3): 769-771; 1976. (3 references)

The climatic conditions in western Canada seemed conducive to carryover of herbicide residues from one growing season to the next, so studies were performed to determine the persistence of herbicides at three locations in Saskatchewan using a small field plot study technique. Practical findings are presented from a three year-study in which herbicides were applied in May of each year at the rates commonly used for weed control. Treatments of diallate, dicamba and 2,4-D degraded over a single growing season, thus residues were not carried over to the following season. Minimal degradation of residues of the other herbicides that persisted to the end of the growing season occurred from the end of October to the beginning of May. After two growing seasons less than 7% of the applied dichlobenil, dinitramine, triallate, and trifluralin remained in the sandy loam soil while less than 12% of these herbicides remained in the heavy clay soils. Simazine was much more persistent in these soils. Breakdown rates were more variably in the soil of higher organic matter content, possible in relation to soil moisture and pH levels as well. Negligible amounts of any herbicide were recovered from the 5-10 10-cm soil depths, indicating minimal leaching.

77-0023. Hager, D. G. (Chemviron, Brussels, Belgium). **Waste treatment advances: waste water treatment via activated carbon.** *Chem. Engn. Progr.* 72(10): 57-60; 1976. (7 references)

Evaluations were made of 107 samples of waste water from manufacturing operations subjected to treatment by activated carbon in a series of adsorption isotherm tests to determine effectiveness in reducing total organic carbon, color, and phenol. In addition to the waste water survey, a selected number of adsorption isotherm tests were conducted on synthetic samples of water containing toxic chemicals as defined by the EPA. The results indicated that 855 removal of total organic carbon was achieved in 79 of 102 samples (77%), 95% removal of color was achieved in 16 of 16 samples (100%), and 99% removal of phenols was achieved in 5 of 5 samples (100%). Toxic chemicals were removed from the synthetic waste samples by over 99% in 9 of 9 samples by activated carbon treatment.

77-0024. Nagayama, J.; Masuda, Y.; Kuratsune, M. (Dep. Public Health, Fac. Med., Kyushu Univ., Fukuoka, Japan). **Chlorinated dibenzofurans in Kanechlors and rice oils used by patients with Yusho.** *Fukuoka Igakkai Zasshi (Fukuoka Med. J.)* 66(10): 593-599; 1975. (20 references)

Various types of Kanechlor, a commercial brand of PCBs prepared in Japan, were examined for their possible contamination by PCDF or PCDD, in an effort to determine if these contaminants were responsible for the Yusho epidemic. Various types of toxic rice oil used by patients with Yusho were also examined for these same contaminants. Kanechlor-300, 400, 500, and 600 were shown to contain 1, 18, 4 and 5 ppm of PCDF, respectively, as calculated by gas chromatographic peak heights, and 1.5, 17, 2.5, and 3 ppm of PCDF, as calculated by the perchlorination method. Kanechlor-400 was thus the most contaminated. Samples of "Yusho oil" also contained about 5 ppm of PCDF, which was much higher than would be expected. PCDD was not detected in any of the materials analyzed. It is suggested that the contaminant PCDF may have played a role in the causation of Yusho.

77-0025. Chin, W. T.; Duane, W. C.; Ballee, D. L.; Stallard, D. E. (Diamond Shamrock Corp., T.R. Evans Res. Cent., Painesville, OH 44077). **Mechanism of degradation of thiofanox in aqueous solutions.** *J. Agric. Food Chem.* 24(5): 1071-1073; 1976. (6 references)

The mechanism of degradation of thiofanox (P) was studied in aqueous solutions by comparing the rates of oxidation and hydrolysis of P, its sulfoxide derivative, 3,3-dimethyl-1- (methylsulfinyl)-2- butanone-*O*-[(methylamino) carbonyl] oxime (P_1) and the sulfone derivative, 3,3-dimethyl-1- (methylsulfonyl)-2- butanone-*O*-[(methylamino) carbonyl]oxime, (P_2). All three carbamates were stable in neutral and acidic solutions at 25°C or lower temperatures. At pH 10, P underwent a two-step oxidation to its sulfone derivative with subsequent hydrolysis of the sulfone. At pH 10 the rate of hydrolysis of the sulfone derivative was determined at 4, 25 and 45°C. No direct hydrolysis of P at pH 10 was noted. Therefore, the oxidation of P to P_2 and the partial hydrolysis of P_1 to its oxime (O_1) with subsequent oxidation of O_1 to the oxime of P_2, (O_2), are all complete in 24 hr at pH 10 and at 4 to 25°C. Pseudo-first-order rate constants for hydrolysis of P_2 to O_2 at pH 10 and 4, 25, and 45°C were determined to be 0.0036, 0.0653 and 0.2427/day with half-lives of 192.5, 10.6, and 2.9 days, resp. As P_2 is the most significant degradation product of P and has the highest toxicity of the three carbamates, the hydrolysis of P_2 to O_2, which has a toxicity 386 times less than that of P_2, is regarded as a detoxifying process.

77-0026. Keenan, R. R.; Stuart, J. D. (Dep. Chem., Univ. Connecticut, Storrs, CT 06268). **Anodic oxidation of DDT, methoxychlor, and related compounds.** *J. Electrochem. Soc.* 123(11): 1637-1642; 1976. (19 references)

The electrochemical oxidation of DDT, methoxychlor, and related compounds is reported. From the controlled potential electrolyses of DDT, DDE, methoxychlor and the ethylene derivative of methoxychlor in 5% aqueous acetonitrile solution the major electrolysis products were hydrolysis products. These were either alcohols, ketones, benzoquinones, or acids, suggesting that nucleophilic attack by water occurred mostly at the electron-deficient carbon located at the central α-carbon of each compound studied. At higher oxidation potential of a voltammetric wave the benzophenone for each compound studied appeared, which supports this theory. The electrochemical oxidation of DDE produced DBA in good yield, while never before reported dimethoxykelthane was obtained in good yield from the electrochemical oxidation of methoxychlor and the ethylene of methoxychlor, 1,1-dichloro- 2,2-bis-(*p*-methoxyphenyl) ethylene. It is noted, however, that in certain cases nucleophilic attack by water did occur on the electron-deficient aromatic ring, allowing a significant amount of 1,1,1-trichloro- 2-(*p*-chlorophenyl) -2- (4-chloro-2,5-benzoquinone) ethane to be isolated from the electrochemical oxidation of DDT. A nucleophilic attack by chloride ion in an anhydrous media onto the electron deficient aromatic ring of methoxychlor was evident.

77-0027. Fenn, R. J.; Krantz, K. W.; Stuart, J. D. (Dep. Chem., Univ. Connecticut, Storrs, CT 06268). **Anodic oxidation of two polychlorinated biphenyls.** *J. Electrochem. Soc.* 123(11): 1643-1647; 1976. (35 references)

Two specific PCBs, 4,4′-dichlorobiphenyl (DCB) and 2,5,2′,5′-tetrachlorobiphenyl (TCB) and typical commercial mixtures of PCBs were oxidized at very high anodic potentials at a platinum electrode in a medium of aqueous acetonitrile and tetraethylammonium fluoborate. As a result of product isolation and the cyclic voltammetric data, a general ECE oxidation scheme is most reasonable for the electrochemical oxidation of DCB and TCB under

these conditions. Therefore, an initial two-electron oxidation followed by hydrolysis would result in the formation of a hydroxychlorobiphenyl (a chlorophenyl phenol). At the controlled working electrode potential, the hydroxychlorobiphenyl would be rapidly further oxidized to the corresponding *p*-benzoquinone. The identification of various benzoquinones and the appearance of numerous minor electrolysis products as seen on the thin-layer chromatographic plate suggest the complexity of the electrochemical oxidation processes. Elimination of the chloro group occurred to a variable extent.

77-0028. Davis, A. C.; Kuhr, R. J. (Dep. Entomol., N. Y. State Agric. Exper. Stn., Geneva, NY 14456). **Dissipation of chlorpyrifos from muck soil and onions.** *J. Econ. Entomol.* 69(5): 665-666; 1976. (3 references)

Chlorpyrifos applied in furrow at rates of 1 or 2 lb AI/acre for protection of onion plants persisted in muck soil at levels above 1 ppm for 16 weeks. Granular formulations yielded slightly higher initial insecticide deposits which disappeared at a slower rate than did emulsifiable concentrates. Chlorpyrifos residues in onion plants never exceeded 1 ppm and most of this was confined to the outer wrapper leaves. (Author abstract by permission)

77-0029. Warlen, S. M. (Author address not given). **Accumulation of organochlorine insecticides by Atlantic menhaden, *Brevoortia tyrannus*, from the Newport River Estuary.** *J. Elisha Mitchell Sci. Soc.* 90(3): 108-109; 1974.

Organochlorine insecticide residues were determined in young-of-the-year Atlantic menhaden, *Brevoortia tyrannus*, while they resided in the Newport River estuary in North Carolina. In 1971 and 1972 DDT was found most frequently and occurred in higher amounts than other insecticide residues, both in menhaden and in the seston which is their food. Dieldrin was found nearly as often as was DDT, but at lower concentrations. Only trace amounts of DDT were present in the sediments. DDT and dieldrin were both concentrated in menhaden in relation to the time the species was in contact with the contaminants. Body burdens of DDT and dieldrin were significantly greater in larvae than in juvenile menhaden. During their stay in the Newport River estuary in 1971, menhaden increased both their DDT and dieldrin concentrations by a factor of four times while their body burdens of DDT and dieldrin each increased over 3,750 times. The food of menhaden is apparently the source of the accumulated residues.

77-0030. Bruce, R. R.; Harper, L. A.; Leonard, R. A.; Synder, W. M.; Thomas, A. W. (USDA, Watkinsville, GA 30677). **A model for runoff of pesticides from small upland watersheds.** *J. Environ. Qual.* 4(4): 541-548; 1975. (18 references)

A research-oriented model for runoff of pesticides from small upland watersheds, having a parametric structure useful for efficient data analysis and learning, is presented. Runoff water is calculated by convolving an area-characteristic and variable state function to produce a variable response function. This response function is then convolved with a computed effective rain. Rill and interrill erosion are conceptually distinguished which allows similar partitioning of associated pesticides. The sediment contribution from interrill erosion is a function of rainfall intensity and soil susceptibility to erosion. Rill erosion is a function of water runoff and the rate of change of water runoff. The pesticide concentration in the runoff is a function of the amount of runoff, the sediment concentrations derived from rill and interrill erosion, and the pesticide concentrations in the respective runoff-erosion zones.

77-0031. Sanyal, N.; Ghosh, D. K. (Author address not given). **Discussion on water quality problems arising from irrigation return flow.** *J. Inst. Eng.* 55(1): 29; 1974. (2 references)

The presence of pesticides, particularly chlorinated hydrocarbons, in water used in irrigation, is responsible for biological accumulation which affects various legitimate uses. Some plant growth regulators and insecticides are quite resistant to biological decomposition. Some tend to be fixed by some types of soils. PCB's, while virtually insoluble in water, are extremely persistent, accumulate in the food chains in fish and birds, and are found all over the world. Agricultural chemicals and fertilizers may be a possible source of this contamination. A continued surveillance of pesticide levels is called for as a matter of human health and safety. Analytical techniques which may aid in determining chlorinated hydrocarbon insecticides in water and wastewater in laboratory analysis may include hexane extraction, diatomaceous earth, column clean-up and gas chromatographic identification and quantitation. For some samples thin layer chromatography and mass spectrometer analysis may be helpful.

77-0032. Lawson, E. R. (Southern For. Exp. Stn., Forest Service, USDA, Fayettesville, AR 72701). **2,4,5-T residues in storm runoff from small watersheds.** *J. Soil Water Conserv.* 31(5): 217-219; 1976. (10 references)

The amount of 2,4,5-T residues appearing in storm runoff from small upland watersheds after the herbicide had been applied by spraying for the control of hardwood brush and sprout was determined. The watersheds were sprayed in September 1971, June 1972, and July 1973. Pressurized backpack sprayers were used to apply 4 pounds acid equivalent per acre of the isooctyl ester on the cleared watershed and 2 pounds per acre on the partially cut watershed. The first runoff-producing rain occurred about 3 weeks after the initial application and samples contained an average of 2.1 ppm of 2,4,5-T on the cleared watershed and 1.0 ppm on the partially cut watershed. By December, runoff rains did not contain detectable amounts of 2,4,5-T. Similar experiences after the other two sprayings support the finding that 2,4,5-T does not persist for extended periods in forest environments. None

of the concentrations detected were sufficiently high to be toxic to man or other mammals or to fish or other aquatic organisms.

77-0033. Gasztonyi, K.; Cseh, M.; Karkas, P. (Author address not given). **Gyorsfagyasztott malna orthocid szermaradek-tarlalmanak lebomlasa melyhuto tarolas alatt. [Decomposition of residues of *Orthocid* in quick-frozen raspberries during storage.]** *Kerteszeti Egy. Kozl.* 38(6): 176-181; 1974. (Hungarian)

The Engst-Schnaak thin layer-chromatographic method was employed to determine the captan content of quick-frozen raspberries. The sample was shaken in chloroform and the raw solution cleaned with acetonitrile, followed by clarification with florisil. The condensed extract was run on Kieselgel G and Polygram Sil G layers with a mixture of hexane and ether in a ratio of 1:1.3. Spots were developed with acetonic $AgNO_3$ solution under UV light. Captan had an *Rf* value of 0.46. The sample being tested contained 3.8 ppm captan and would require a rather long period of storage at -10°C for decomposition to occur, not less than 8 months.

77-0034. Okada, S.; Ueda, E.; Uno, M.; Kataoka, S. (Nara Prefect. Lab. Hyg., Nara, Japan). **[Residues of fenitrothion following aerial application.]** *Nippon Koshu Eisei Zasshi (Jpn. J. Public Health)* 23(10 Suppl.) 698; 1976. (Japanese)

The behavior of fenitrothion in the air due to aerial application for controlling *Monochamus alternatus*, the vector of timber-rot nematodes, was studied by applying a 20 fold dilution of fenitrothion 50% EC at 50 l/ha from a helicopter, collecting the air, and determining the fallout. It was found that in places near the applied area the fallout dropped sharply from 20 $\mu g/m^2$/min to 0.02 $\mu g/m^2$/min within 30 min of application, and after that the fallen amount gradually decreased, the total amount of fallout accounting for 90% of the applied amount in 30 min. The aerial residue also suddenly decreased from about 4 $\mu g/m^3$ to 0.05 $\mu g/m^3$ within 7 hr, and then gradually declined. These data were obtained in calm weather. It was concluded that the major amount of applied pesticide had fallen in a relatively narrow area; however, meteorological conditions should not be neglected. The aerial concentration of fenitrothion was one thousandth of the no-effect level, and therefore, considering its transiency, should not directly affect human health.

77-0035. Cross, D. J. (Forest Res. Inst., New Zealand Forest Service, Rotorua, New Zealand). **Persistence of organo-chlorine insecticides in wood after twenty-five years.** *Mater. Organism.* 11(2): 145-157; 1976. (7 references)

A study of the effectiveness of various insecticides in preventing attack by *Anobium* was undertaken in 1952 by treating a group of kahikatea (*Dacrycarpus dacrydioides*) blocks with dieldrin, γ-HCH, DDT, or DDD (TDE). Over the period of testing, only the 0.2% DDT treatment failed to prevent infestation. Other concentrations tested included 5.0%, 3.5%, 2.0%, 1.0%, and 0.5%. Over the 25 yr period dieldrin residues persisted very much better than did γ-HCH, particularly at the 0.5% treating rate. These pesticides have a long lifetime in wood and the treating of timber for several years has established a considerable reservoir of the material. While it is reasonably safe in timber, progressive demolition of older houses will almost certainly release dieldrin into the environment by either burning or leaching. By whichever path, dieldrin will ultimately accumulate at the same point in the ecosystem as agriculturally applied chemical. The amounts being considered are significant in that about 0.3 kg of active ingredient is applied per house at a single spraying, representing many tons for an urban area.

77-0036. Suzuki, M.; Yamato, Y.; Watanabe, T. (Pestic. Residue Lab., Kitakyushu Munic. Inst. Environ. Health Sci., Tobata-Ku, Kitakyushu, Japan 804). **Organochlorine insecticide residues in vegetables of the Kitakyushu District, Japan—1971-74.** *Pestic. Monit. J.* 10(2): 35-40; 1976.

The residue levels of organochlorine insecticides BHC, DDT, endrin, and dieldrin in the Kitakyushu District, Japan, were monitored from 1971 to 1974. Agricultural uses of these insecticides were banned in 1970. BHC isomers, α-, β-, γ-, and δ-BHC were detected in all vegetable samples taken; β-BHC residue appeared in the highest levels. The proportions of each BHC isomer in total BHC residues were much different from those in the technical product. Average residue levels of α-, β-, γ-, and δ-BHC, dieldrin, endrin, and DDTR (*p,p'*-DDT + *p,p'*-DDE + *p,p'*-TDE + *o,p'*-DDT) in 1971 were 0.007, 0.042, 0.010, 0.008, 0.021, 0.010, and 0.041 ppm in radishes, and 0.004, 0.007, 0.009, 0.003, 0.087, 0.031, and 0.009 ppm in cucumbers. Levels found in 1974 were 0.002, 0.003, < 0.001, < 0.001, 0.005, 0.006, and < 0.001 ppm in radishes, and < 0.001, 0.001, 0.001, < 0.001, 0.008, 0.009, and undetectable in cucumbers. These residues were translocated from the insecticide-contaminated field soils to the vegetables through their roots. Residue levels of dieldrin and endrin frequently exceeded the pesticide tolerance limits of Japan, but DDTR residues were only slightly above the specified levels. (Author abstract by permission)

77-0037. Yang, H. S. C.; Wiersma, G. B.; Mitchell, W. G. (Ecol. Monit. Br., Tech. Serv. Div., Office of Pesticide Programs, U.S. Environ. Protect. Ag., Washington, DC 20460). **Organochlorine pesticide residues in sugarbeet pulps and molasses from 16 states, 1971.** *Pestic. Monit. J.* 10(2): 41-43; 1976. (6 references)

Sugarbeet pulp and molasses from 57 processing plants in 16 States were sampled for pesticide residues. No molasses samples contained detectable pesticide residues, but about 15 percent of the pulp samples contained low levels of dieldrin, toxaphene, or DDT and its degradation products. Sugarbeet pulp, when used as animal feed, can

be a source of pesticidal contamination of human food. (Author abstract by permission)

77-0038. Clark, D. R., Jr.; Prouty, R. M. (Fish Wildl. Serv., U.S. Dep. Interior, Patuxent Wildl. Res. Cent., Laurel, MD 20811). **Organochlorine residues in three bat species from four localities in Maryland and West Virginia, 1973.** *Pestic. Monit. J.* 10(2): 44-53; 1976. (6 references)

In 1973, 119 bats of three species were collected from four localities in Maryland and West Virginia. The collection included 43 big brown bats (*Eptesicus fuscus*), 43 little brown brown bats (*Myotis lucifugus*), and 33 eastern pipistrelles (*Pipistrellus subflavus*). The bats were collected from Round Top Mountain, Washington Co., Md.; Trout Cave, Pendleton Co., W. Va.; Montpelier Barn, Prince Georges Co., Md.; and North East Methodist Church in Cecil Co., Md. Residues of ΣDDT were highest in carcasses of bats from Round Top Mountain, which is surrounded by apple orchards. Bats from Trout Cave had the lowest residues, a circumstance which probably reflects the absence of agriculture and industry in the area. A polychlorinated biphenyl (PCB) and oxychlordane were highest at Montpelier Barn. Sources of the PCB are unknown, but chlordane is used against termites and in gardening at nearby housing developments. Residues in bats from North East Methodist Church were low except for dieldrin. Among species, little brown bats usually had the highest residue concentrations in their carcasses, whereas big brown bats had the lowest. When DDE in carcass fat of all species was about 60-90 ppm, it became measurable in brain tissue. Above 60-90 ppm, DDE levels in brains rose with increasing levels in carcass lipids. Residues of the PCB tended to respond similarly. Residue levels in brains were greatest in little brown bats; the maximum level of the PCB, 7.9 ppm, was more than twice that of DDE. (Author abstract by permission)

77-0039. Carey, A. E.; Wiersma, G. B.; Tai, H. (Project Officer, Natl. Soils Monit. Prog., Tech. Serv. Div., U.S. Environ. Protect. Ag., Washington, DC 20460). **Pesticide residues in urban soils from 14 United States cities, 1970.** *Pestic. Monit. J.* 10(2): 54-60; 1976. (4 references)

Soil in 14 cities was sampled and analyzed for arsenic and chlorinated hydrocarbon pesticide residues. Heavy loads of chlorinated hydrocarbon residues were detected in the soil. In addition to DDT and its metabolites, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, and toxaphene were detected. Distinct variations appeared in some residue levels among cities. Pesticide residue levels in urban soils were generally higher than the residue levels detected in cropland soils of the same States. (Author abstract by permission)

77-0040. Glooschenko, W. A.; Strachan, W. M. J.; Sampson, R. J. C. (Process Res. Div., Canada Cent. Inland Waters, P.O. Box 5050, Burlington, Ontario, Canada L7R 4A6). **Distribution of pesticides and polychlorinated biphenyls in water, sediments, and seston of the Upper Great Lakes—1974.** *Pestic. Monit. J.* 10(2): 61-67; 1976. (25 references)

Samples of water, seston, and sediment from the upper Great Lakes were collected during the summer of 1974 for analyses of polychlorinated biphenyls (PCB's), 15 organochlorine pesticides, and 17 organophosphorus pesticides. Samples were taken from 9 sites in Lake Huron, 2 in the North Channel, 5 in Georgian Bay, and 17 in Lake Superior. In the water samples all compounds analyzed were below quantification limits and traces of lindane were found in each sample. In seston samples, PCB's were above quantification limits at nearly every station and some traces of dieldrin and DDE were measured. Sediments contained PCB compounds at all stations. Dieldrin was occasionally observed, and DDT and/or its derivatives DDE and TDE were found in over one-third of all samples. No clear correlation was found between quantities of these compounds in sediments and either the percentage of clay or organic matter in the samples. Nor were any definite geographic trends present in terms of distributions observed, although concentrations were higher in areas of higher sedimentary deposition such as deeper basins. No organophosphorus compounds were detected in any sample. The highest level of DDT residues detected, 20 ppb, was lower than levels found in other studies in the lower Great Lakes and some tributary river sediments of Georgian Bay. In general, DDT residues were higher in Lake Huron and Georgian Bay sediments than in Lake Superior although PCB's were higher in some Lake Superior sediments. (Author abstract by permission)

77-0041. DeJonckheere, W.; Steurbaut, W.; Kips, R. H. (Dep. Crop Protect. Chem., Fac. Agric. Sci., State Univ. Ghent, Belgium). **Residues of quintozene, its contaminants and metabolites in soil, lettuce, and witloof-chickory, Belgium—1969-74.** *Pestic. Monit. J.* 10(2): 68-73; 1976. (15 references)

The authors studied contamination of soils used to raise lettuce in greenhouses and witloof-chicory (French endive) in forcing beds. The crops had been treated with the fungicide quintozene; residues detected included quintozene, its technical impurities and metabolites hexachlorobenzene, pentachlorobenzene, pentachloroaniline, and pentachlorothioanisole. Analyses of 72 soil samples indicated that soils remain contaminanted with these chemicals one or more years after application. This is attributed to the high persistence of quintozene, its impurities and metabolites, and the almost annual application of the fungicide. Analyses of the crops show that quintozene, hexachlorobenzene, and pentachloraniline are taken up from contaminated soils, especially by lettuce. Pentachlorothioanisole, although present in the soils, was not detected in the crops. (Author abstract by permission)

77-0042. Bullivant, M. J.; Pattenden, G. (Dep. Chem., The University, Nottingham NG7 2RD, England). **Photodecomposition of natural pyrethrins and related compounds.** *Pestic. Sci.* 7(3): 231-235; 1976. (10 references)

Fundamental chemical transformations involved during the photodecomposition of the pyrethrins and the bearing that these factors have on the losses in insecticidal activity of the molecules are studied. The photochemistry of the chrysanthemic acid and rethrolone molecules was investigated. Consideration of available data suggests that an overall two to four-fold loss in activity of the pyrethrins may be anticipated as a result of isomerization and racemization of the (+)-trans-chrysanthemic acid moiety of the insecticides during photodecomposition. Photolysis of bioallethrin resulted in a greater than 95% conversion of a single photoproduct which has a less than 1% knockdown with female *Aedes aegypti* mosquitoes and about a 10% knockdown with *Musca domestica* in comparison with allethrin.

77-0043. Roberts, T. R.; Stoydin, G. (Shell Res. Ltd., Woodstock Lab., Sittingbourne Res. Cent., Sittingbourne, Kent, England). **The degradation of (*Z*)- and (*E*)-1,3-dichloropropenes and 1,2-dichloropropane in soil.** *Pestic. Sci.* 7(4): 325-335; 1976. (44 references)

The degradation in soil of the major constituents of a 1,3-dichloropropene/1,2-dichloropropane nematicide has been studied under laboratory and outdoor conditions. In sealed glass containers, (*Z*)- and (*E*)-1,3-dichloropene-2-^{14}C were converted in soil into the corresponding 3-chloroallyl alcohols and these alcohols were in part strongly bound to the soil. The (*Z*)- and (*E*)-3-chloroacrylic acids were also found as minor products. More polar products were detected and these released the chloroacrylic acids in 20-30% yield upon hydrolysis. Although the 1,3-dichloropropenes were lost by volatilization from soil stored in open glass jars outdoors, they also underwent degradation to the same products that were detected in sealed containers. There was evidence of only slight degradation of 1,2-dichloropropane-2-^{14}C (4% or less of the applied radioactivity remained unextracted from a loam soil after 5 months). When soil treated with the 1,2-dichloropropane was stored outdoors in an open glass container, less than 1% of the original radiolabel remained in the soil after 10 days under these conditions due to volatilization of the applied material. In a separate experiment potatoes were grown in soil 6 months after treatment with a mixture of both (*Z*)- and (*E*)-1,3-dichloropropene-2-^{14}C and 1,2-dichloropropane-2-^{14}C. Although 5% of the applied radiolabel remained in the soil at potato harvest the potato tubers contained only a very small residue (0.007 mg/kg). (Author abstract by permission)

77-0044. Verweij, A.; Boter, H. L. (Chem. Lab., TNO, PO Box 45, Rijswijk, The Netherlands). **Degradation of *S*-2-di-isopropylaminoethyl *O*-ethylmethylphosphonothioate in soil: phosphorus-containing products.** *Pestic. Sci.* 7(4): 355-362; 1976. (12 references)

The degradation of *S*-2-di-isopropylaminoethyl *O*-ethyl methylphosphonothioate in humic sand, humic loam and clayey peat has been studied under laboratory conditions. About 90% of the compound disappeared within 2 days and the remainder disappeared more slowly. Ethyl hydrogen methylphosphonate and methylphosphonic acid were identified as the only phosphorus-containing degradation products. (Author abstract by permission)

77-0045. Hance, R. J. (Agric. Res. Counc., Weed Res. Org., Begbroke Hill, Yarnton, Oxford, England). **Adsorption of glyphosate by soils.** *Pestic. Sci.* 7(4): 363-366; 1976. (11 references)

The adsorption of glyphosate in a slurry system by 9 soils was correlated with an arbitrary single point inorganic phosphate sorption index which gave a measure of unoccupied phosphate sorption capacity, but not with total phosphate sorption with clay content, organic matter content or pH. It is concluded that inorganic phosphate excludes glyphosate from sorption sites. The extent of adsorption was higher than, though of the same order as, that of diuron though the two are not related. From consideration of the results of previous experiments with plants grown in culture solution it is suggested that the low toxicity of glyphosate applied to the soil is not due simply to high adsorption. Rather it is the result of a combination of moderate adsorption and the low intrinsic activity of this compound when made available to the root system. (Author abstract by permission)

77-0046. Gajduskova, V.; Lat, J. (Nat. Inst. Vet. Med., Brno, Czechoslovakia). **Vliv technologie na rezidue organofosfatu v mlece a mlecnych vyrobcich. [The effect of technology on organophosphate residues in milk and milk products.]** *Prum. Potravin* 25(3): 95-96; 1974. (4 references) (Czech)

Malathion (Mth), fenitrothion (Fth), and dichlorvos (Dch) were dissolved in ethanol and added to whole milk at a concentration of 10 mg/kg. After 1 day of storage at 4°C, Mth was reduced by 29.6%, Fth by 2.5%, and Dch by 12.5%, while after 2 days of storage these figures were 39.0%, 16.9%, and 16.6%, respectively. Pasteurization at 65°C for 30 min. resulted in an 8.5% reduction of Mth, a 2.5% reduction in Fth, and a 13.4% reduction in Dch, while pasteurization at 85°C for 2 min. caused reductions of 9.0%, 15.0%, and 16.2%, respectively. For some other processing methods, respective reductions in Mth, Fth, and Dch were: after boiling for 2 min. 10.5%, 12.5%, and 19.5%; after sterilization (120°C for 20 min.) 33.5%, 17.4%, and 94.7%; and under the effect of a 0.03% concentration of hydrogen peroxide for 15 min. 18.0%, 16.2%, and 17.0%. After milk separation (rotation rate of 7000 l/min. for 15 min.), 89.8% of the Mth, 83.8% of the Fth, and 39.1% of the Dch was in the fat phase, while 10.2% of the Mth,

16.2% of the Fth, and 60.9% of the Dch was in the plasma (0.05% fat). These data indicate that some organophosphates can accumulate in butter. Souring of the milk by the addition of a 1% sour cream starter reduced Mth by 40.0%, Fth by 22.6%, and Dch by 29.2%, after 45 wk. of storage, while addition of a 1% yogurt culture reduced Mth by 42.5%, Fth by 9.0%, and Dch by 23.1% after 22 wk. of storage. During souring in the presence of the pesticides, inhibition of the pure bacterial cultures and morphological changes in the cells occurred. It is evident from the above results that the inspection of milk for the presence of organophosphates is necessary.

77-0047. Bradt, P. T.; Herrenkohl, R. C. (Dep. Biol., Lehigh Univ., Bethlehem, PA 18015). **DDT in human milk. What determines the levels?** *Sci. Total Environ.* 6(2): 161-164; 1976. (7 references)

Fifty-five samples of human milk taken from women in eastern Pennsylvania were analyzed for DDT and its metabolites. DDT or its metabolites was found in 54 of the samples. The mean of total DDT derived products in the 55 samples was 0.114 μg/g, the range was 0.0 to 0.298 μg/g. FDA tolerance level (0.10 ppm) was exceeded in 26 (47%) of the samples. Samples of cows' milk (5 samples) also contained DDT and its metabolites, with the mean of total DDT being 0.007 μg/g. These levels were within acceptable FDA standards. No detectable DDT or metabolites were found in the infant formula tested. Additional studies revealed that the levels of total DDT in human milk decrease as the number of children nursed increases, and that cigarette smoke may be a source of the human body burden of DDT or may cause more DDT to be excreted in the milk. It is urged that mother's milk be tested in underdeveloped countries where DDT is in continued use to determine if the level of contamination exceeds recommended safe levels.

See also **77-0104** **77-0105** **77-0106** **77-0223**

77-0048. Espanol, A. O. (Serv. Def. Plag. Inspecc. Fitopathol., Barcelona, Spain). **Necesidad de una legislacion limitativa al uso de pesticidas.** [**Need for legislation limiting the use of pesticides.**] *Afinidad* 33(1): 15-19; 1976. (Spanish)

Pesticides are indispensable in agriculture, but have fallen into disrepute because of reports that they upset the balance of nature, exerting excessive effects on non-target organisms. About 6 million pints of plant protection chemicals are used each year in Spain, accounting for about 1.7% of the estimated world total, and Barcelona accounts for less than 4% of this quantity. Insecticides, fungicides, and herbicides, in that order, account for the bulk of this quantity; largest amounts are applied in fruit growing. The number of products registered in Spain increased from 700 in 1953 to 5000 in 1973. The Spanish Pest Control and Phytosanitary Inspectorate was established under the Ministry of Agriculture in 1972 as a monitoring and enforcement agency covering both pest control and pesticide use. The first registration limiting the use of a pesticide was applied to DDT in 1971. A regulation issued in 1965 and expanded in 1973 calls for the assignment of pesticides into three categories based on the risk afforded to humans, domestic animals, and the forest, terrestrial, and aquatic fauna. Supplementary regulations were issued on herbicidal hormones. Increased emphasis is being placed on methods of preventing the spread of pests before they become entrenched.

77-0049. Felsenstein, W. C.; Staiff, D. C.; Miller, G. C. (Pestic. Toxic Substances Effects Lab., U. S. Environ. Protect. Ag., Wenatchee, WA 98891). **Acute demeton poisoning in a child.** *Arch. Environ. Health* 31(5): 266-269; 1976. (8 references)

An acute case of demeton poisoning in a child is described. Initially, typical signs of organophosphate poisoning were not present, and the illness was thought to be aliphatic hydrocarbon (fuel oil) intoxication. When correct diagnosis was first suspected, treatment with pralidoxime chloride and atropine sulfate produced some perilous complications, but was probably life-saving ultimately. Plasma (pseudo) cholinesterase levels 15 to 41 hours after exposure ranged from 0.24 to 0.48 international units (IU). Approximate normal value (2.5 IU) was not reached until 5 1/2 days after exposure. Transdermal poisoning by demeton was confirmed by its presence (15.4 mg/l) in the suspected fuel oil and, at high levels, in several articles of the child's clothing. Verification of expected urinary metabolites helped confirm the diagnosis of demeton poisoning. The availability of rapid blood cholinesterase field tests in hospital laboratories, especially in agricultural areas, is pointed out as an urgent need. (Author abstract by permission)

77-0050. Deichmann, W. B.; MacDonald, W. E. (Res. Teaching Cent. Toxicol., Dep. Pharmacol., Univ. Miami Sch. Med., Coral Gables, FL 33124). **Liver cancer deaths in the continental USA from 1930 to 1972.** *Am. Ind. Hyg. Assoc. J.* 37(9): 495-498; 1976. (5 references)

One of the primary reasons for the ban on organochlorine pesticides was the possibility of their causing liver cancer in the human population. About 1.2 billion kilograms of DDT and 865 million kilograms of the aldrin-toxaphene compounds were manufactured in the USA from 1950 to 1970; "domestic disappearance" accounted for about half of the first quantity and five-sixths of the latter. Mortality statistics were examined to detect any possible increase in liver cancer deaths following the introduction of organochlorine compounds. The statistics revealed a significant, almost constant decline in the overall liver cancer death rate from 8.8 per 100,000 population in 1930 to 8.4 in 1944 and 5.6 in 1972. These statistics were not corrected for increases in life span. General population studies of this type might fail to reveal a very low potential for causing liver cancer in man.

77-0051. Okonek, S.; Hofmann, A.; Hennigsen, B. (Cent. Detox. Poison Inform., II. Med. Clin., Univ. Mainz, D-6500 Mainz, Germany). **Efficacy of gut lavage, hemodialysis, and hemoperfusion in the therapy of paraquat or diquat intoxication.** *Arch. Toxicol.* 36(1): 43-51; 1976. (27 references)

Clinical and in vitro investigations were carried out to test the efficacy of gut lavage, hemodialysis, and hemoperfusion in the treatment of poisoning with paraquat or diquat. In a patient with diquat intoxication 130 times more diquat was removed by gut lavage 30 hr after ingestion than by complete aspiration of gastric contents. At serum concentrations of 1-2 ppm, such as are frequently encountered in human poisoning, toxicologically relevant quantities of herbicide cannot be removed from the body by hemodialysis according to in vitro clearance studies. Hemodialysis was effective at a concentration of 20 ppm: the clearance was 70 ml/min at a flow rate of 100 ml/min. Hemoperfusion with coated activated charcoal was more effective. The clearance values for hemoperfusion were ca. 5-7 times higher than those for hemodialysis, especially at concentrations around 1-2 ppm. Tests in a patient with paraquat poisoning confirmed the in vitro results: at a serum paraquat concentration of less than 1 ppm no clearance could be obtained by hemodialysis, while high clearance values were measured by hemoperfusion with activated charcoal, reducing the serum level to zero. (Author abstract by permission, abridged).

77-0052. Bogden, J. D.; Quinones, M. A.; Nakah, A. E. (Dep. Prevent. Med. Community Health, CMDNJ-New Jersey Med. Sch., Newark, NJ). **Pesticide exposure among migrant workers in southern New Jersey.** *Bull. Environ. Contam. Toxicol.* 13(5): 513-517; 1975. (6 references)

During the summer of 1973, 593 people (409 adults and 184 children, mostly 20-29 yr of age) were examined under a mobile health screening program for rural poor farm workers in New Jersey. The most prevalent com-

plaints reported resemble the subtle early manifestations of inordinate pesticide exposure, e.g., frequent headaches, dizziness, blurred vision, and a general feeling of weakness. The widespread use of pesticides in the agricultural industry provides considerable opportunity for migrant farm workers to be exposed to these toxic chemicals. Pesticides are particularly hazardous for farm workers as oral ingestion is generally not necessary. Most cases of pesticide poisoning occur from inhalation of pesticide dust or vapors or accidental contact with clothing and skin, with subsequent absorption through the skin. In the workers in this study generally depressed cholinesterase activities were found, with one-third of the migrants having activities below the lower limit of normal, 3.6 U/ml.

77-0053. Franklin, M. R. (Dept. Biopharm. Sci., Univ. Utah, Salt Lake City, UT 84112). **Methylenedioxyphenyl insecticide synergists as potential human health hazards.** *Environ. Health Perspect.* 14: 29-37; 1976. (44 references)

Potential human health hazards of methylenedioxyphenyl insecticide synergists are reviewed. The concern arises not from the intrinsic toxicity of these compounds, for that is relatively low. The concern comes about because of their dual effect on the oxidative detoxication or intoxication processes of the body. These compounds can inhibit the reactions by two mechanisms. As they are substrates for mixed function oxidation, they compete with other xenobiotics for available enzyme. An intermediate in their metabolism is able to bind with cytochrome P-450, forming an inactive complex which absorbs maximally at 455 nm. They can also activate xenobiotic metabolism by induction of microsomal oxidative enzymes. It is this inhibition and induction of cytochrome P-450, the central enzyme in the metabolism of xenobiotics, which provides the center of concern for methylenedioxyphenyl synergists as potential health hazards. The balance of the two effects of inhibition and induction at a time when an individual is exposed to a second drug or foreign compound may be critical in determining the consequences. Also, the relative stability, or persistence, of the inactive cytochrome P-450 complex raises the possibility of additive inhibitory effects from exposure to the synergists several days apart.

77-0054. Kimbrough, R. D. (Cent. Dis. Contr., Pub. Health Serv., US Dep. HEW, Atlanta, GA 30333). **Toxicity and health effects of selected organotin compounds: a review.** *Environ. Health Perspect.* 14: 51-56: 1976. (38 references)

Selected tin compounds are reviewed for their toxicity. Various uses have been found for organic and inorganic tin compounds as fungicides, stabilizers in plastics, molluscicides, and miticides. The field of insect chemosterilants has also employed organotin compounds. Many of the chemicals make diets unpalatable and are thus recommended as rodent repellents. Inhalation of tin dust or fumes causes benign pneumoconiosis in exposed workers. Organotin compounds are divided into alkyltin and aryltin structures. The trimethyl and triethyltin compounds are absorbed well from the gastrointestinal tract and are most toxic. Triethyltin in particular produces status spongiosus of the white matter of the central nervous system. Other alkyl and aryl tin compounds are not well absorbed and thus are less toxic when given orally than when given parenterally. Tricyclohexyltin hydroxide is now registered by the EPA as a miticide, and produced skin irritation in rabbits. Studies are suggested to determine whether it is irritating to human skin as well.

77-0055. Peters, H. A. (Univ. Wisconsin Med. Cent., Madison, WI 53706). **Hexachlorobenzene poisoning in Turkey.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 35(12): 2400; 1976. (52 references)

A review of the porphyria cutanea tarda induced by HCB in southeastern Turkey in 1957 was considered advisable in view of the continued use of HCB and its tendency to accumulate and be excreted in mothers' milk. Symptoms of this affliction may be cutaneous, hepatic, arthritic, visceral, urinary, and neurological. Cutaneous symptoms are often precipitated by sunlight, and differences in susceptibility have been reported. A therapeutic trial of EDTA administered orally (with initial intravenous administration in some patients) was performed in seven patients who remained symptomatic with porphyria. Four of the EDTA-treated patients became asymptomatic within three months, and all patients were completely asymptomatic within one year. After cessation of treatment one patient underwent relapse ten months later, followed by abrupt recovery on resumption of EDTA therapy.

77-0056. Clarkson, T. W.; Amin-Zaki, L.; Al-Tikrita, S. K. (Univ. Rochester Sch. Med., Rochester, NY 14642). **An outbreak of methylmercury poisoning due to consumption of contaminated grain.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 35(12): 2395-2396; 1976. (16 references)

An outbreak of methylmercury poisoning took place in the fall and winter of 1971-72 in Iraq. Six thousand five hundred and thirty cases were admitted to hospitals throughout the country and 459 died in hospital. The outbreak was the result of eating homemade bread prepared from wheat treated with a methylmercury fungicide. The wheat was intended for planting purposes only. Signs and symptoms of poisonings in adults indicate that the major site of action of this form of mercury is the central nervous system. Severe brain damage also resulted from prenatal exposure when the mother ingested large amounts of the contaminated bread. The frequency of signs and symptoms in an exposed population was found to be related to the estimated maximum blood levels, i.e., the concentration in blood at the end of exposure. A small percentage of the population exhibited a significant increase in complaints of paresthesia at maximum blood levels in the range of 240 to 480 ng Hg/ml. At higher blood

levels a greater proportion of the population complained of paresthesia and other signs and symptoms became apparent. (Author abstract by permission)

77-0057. Carson, D. J. L.; Carson, E. D. (Dep. Forensic Med., Inst. Pathol., Grosvenor Rd., Belfast, Ireland). **The increasing use of paraquat as a suicidal agent.** *Forensic Sci.* 7(2): 151-160; 1976. (14 references)

Twenty-six fatal (19 men and 7 women, aged 6-78 yr) and seven non-fatal poisonings in Northern Ireland through the use of paraquat are reported. These occurred during the period from 1964 to 1975. The earlier poisonings were due to accidental ingestion resulting from the storage of the chemical in improperly labeled containers. However, of the 16 fatal poisonings occurring since July 1973, no less than 14 have been suicidal. The amounts ingested in the fatal cases ranged from a sip or a mouthful, immediately ejected, to more than 500 ml. Survival time ranged from 16 hr to 23 days, and appeared to be directly related to the amount of paraquat ingested. The differences in the amounts ingested are also reflected in the results of the toxicological analyses of urine samples obtained during life, and of the body fluids and tissues at autopsy. From such analyses it is usually possible to categorize a given case as suicide or accidental ingestion. Homicidal poisoning should be kept in mind as a possibility in these cases. Techniques presently available may be used to determine a blood level of paraquat below which lung damage is unlikely or can be prevented.

77-0058. Kahn, E. (Epidemiol. Studies Lab., California State Dep. Health, Berkeley, CA). **Pesticide related illness in California farm workers.** *J. Occupational Med.* 18(10): 693-696; 1976. (6 references)

Considerable evidence exists that farm workers are adversely affected by pesticide residues. Most of this evidence is indirect. The true magnitude of the problem is not certain as cases are largely undetected and grossly underreported. Important socio-economic and cultural factors involved must be understood and carefully evaluated in any attempt to study this problem. Because of repeated episodes of mass poisonings among work crews, California has established safety regulations in the form of reentry intervals, which are specified periods of time which must elapse after a crop is sprayed with certain pesticides before work crews can enter the field or grove. A partial answer to the problem of unreported cases may result from the nonspecific nature of the early and milder symptoms of organophosphate poisoning, making it easy for both the worker and the physician to overlook their occupational origin. Also the cultural, linguistic, economic, and psychological factors that affect the relation of the group of farm workers to the available health care services are a problem.

77-0059. Anonymous. **Paraquat poisoning.** *Lancet* 1(7968): 1057; 1976. (24 references)

The ingestion of a small, but fatal, dose of paraquat is often followed by a distinct lack of clinical symptoms. Ulceration of the tongue, throat, and esophagus may be the only findings. Urine analysis can confirm paraquat poisoning, but does not aid in determining the amount taken. Measurement in the blood is accurate but time consuming. The human lung can accumulate paraquat from low concentrations in the plasma. This time-dependent process explains the delay in onset of pulmonary symptoms. The speedy reduction of the concentration circulating in the blood, thus preventing the deadly accumulation by the lung, is the main plan of therapy. The most effective approach may be a combination of intensive procedures aimed at reducing the quantity in the gut. Sustained gastrointestinal purging and hemoperfusion may well prevent fatal lung damage in cases where relatively small amounts were ingested, such as accident cases or some suicide attempts. When large amounts have been ingested however, many vital organs are quickly damaged, and none of the existing treatments is likely to be effective.

77-0060. Ward, C. D.; Stones, D. P. A.; Connell, H.; Cullen, D. R.; Watkin, J. I. (Royal Hosp., Sheffield S1 3SR, England). **Paraquat poisoning.** *Lancet* 1(7971): 1247; 1976. (2 references)

In this letter to the editor a case of paraquat poisoning is reviewed. Even though it was known that the victim had been exposed to various weed killers during crop spraying, contact with paraquat had been denied. The diagnosis of paraquat poisoning was rendered only after death from analysis of urine collected during the patient's illness. This case highlights the importance of considering paraquat poisoning in any instance in which there is unexplained jaundice, especially if accompanied by pharyngitis. There is a simple and specific urine test for paraquat which should be routinely available in all hospitals at all times.

77-0061. Anonymous. **Seveso.** *Lancet* 2(7980): 297; 1976.

The production of TCDD occurs as an unwanted contaminant in the synthesis of 2,4,5-trichlorophenol. TCDD, one of the most toxic substances known, causes chloracne, hirsutism, personality changes, and may result in liver malfunction. TCDD poisoning therapy is purely symptomatic and is complicated by the metabolic and chemical stability of the compound. TCDD is concentrated in the liver and fatty tissues, making its half-life in the human body long. TCDD released at Seveso has caused many problems. As the compound is very firmly bound to the soil and is not translocated in groundwaters, the topsoil and vegetation will have to be removed and buried. As TCDD is stable up to temperatures of 700°C, fire will not be helpful. Extreme care is needed in disposing of TCDD residues, as became evident when improper disposal resulted in the deaths of 48 of 85 horses exercised in one arena where a mixture of waste oils and TCDD wastes was used to control dust.

77-0062. Dally, S. (Clin. Toxicol., Hosp. Fernand Widal, 75010 Paris, France). **Paraquat poisoning risk.** *Lancet* 2(7987): 689; 1976. (1 reference)

In this letter to the editor it is suggested that the risk due to paraquat poisoning might be considered quite high if it were viewed in light of the relatively small number of people who have access to the chemical, rather than considering the number of deaths from paraquat in relation to a total population.

77-0063. Halliwell, B. (Dep. Biochem., King's Coll., London WC2R 2LS, England). **Ascorbic acid and paraquat toxicity.** *Lancet* 2(7990): 854; 1976.

In this letter to the editor it is suggested that effective treatment against paraquat poisoning may lie in the use of a compound which, when transported to the lung, can react with superoxide. Ascorbic acid is such a compound, entering the lung from the blood and accumulating in the fluid lining the air spaces. Its reaction with superoxide has been directly demonstrated. As massive doses of ascorbic acid do not seem significantly harmful to man, it is suggested that this avenue of study be tried in the treatment of paraquat poisoning.

77-0064. Rasmussen, R. W.; Cole, G. A. (Mayo Clin., Rochester, MN 55901). **The spectrum of agricultural medicine.** *Minn. Med.* 59(8): 536-539; 1976. (26 references)

The hazards to which agricultural workers are exposed are reviewed according to their etiologies. The five major problems in agricultural medicine are: farm accidents, infectious diseases, chemical toxicity, respiratory conditions, and environmental exposures. Chemicals used in the agricultural industry are categorized as insecticides, rodenticides, fungicides, herbicides, fumigants, and fertilizers. Some of the most toxic are the insecticides. The toxicity may vary with the degree of exposure and the solvent in which the agent is dissolved. Chlorinated hydrocarbons may produce intoxication via inhalation, ingestion, or percutaneous absorption. Phosphate ester or organophosphate insecticides are toxic through their irreversible inhibition of cholinesterase, and may enter the body through skin absorption, lungs, or gastrointestinal tract. The rodenticides, used for many years, have significant Toxicity. Commonly used fungicides of the dithiocarbamate group are of relatively low toxicity to man. Herbicides or weed killers have been associated with relatively few adverse effects. Toxic effects of the fumigants, including hepatic necrosis and a renal tubular necrosis-like picture, are well recognized.

77-0065. Hay, A. (Author address not given). **Seveso: the aftermath.** *Nature* 263(5578): 538-540; 1976.

On July 10 an accident occurred at the ICMESA chemical plant in Seveso, Italy. A reactor producing trichlorophenol overheated, with the result that the rapid pressure increase led to the discharge of the reactor contents through a safety valve directly into the atmosphere. Current recommendations have included the suggestion that residents from this area should have medical tests for the rest of their lives, that the contaminated area should be monitored for decades, that this and a buffer zone should be sealed off to all but authorized personnel, and that decontamination procedures should involve the creation of forests and dismantling of buildings rather than the shifting of earth and the washing of buildings. Reduced white cell counts are still worsening in the people exposed. The desire for abortions among women pregnant at the time of the accident is causing examination of the Italian laws regarding abortion. The need for continued production of trichlorophenol is being seriously questioned, especially in light of the fact that there other chemicals available for the same work which do not require a dangerous synthetic process. Mention is made of the accidental release of arsenious oxide from the ANIC chemical plant near Manfredonia on the Adriatic coast on 26 September of this year.

77-0066. Yoshitomi, K. (Miyazaki Prefect. Lab. Hyg., Miyazaki, Japan). [**Effects on applicators of low toxicity organophosphorus pesticides during application.**] *Nippon Koshu Eisei Zasshi (Jpn. J. Public Health)* 23(10 Suppl.): 609; 1976. (Japanese)

The concentration of a metabolite of fenitrothion, 4-nitro-*m*-cresol, excreted in the urine of applicators of fenitrothion was determined before and after application. The time change of excretion was studied in relation to the position, clothing, and subjective symptoms of the operators. The concentration of urinary 4-nitro-*m*-cresol showed a maximum 6 hrs after application, then showed gradual reduction, and the level became equal to that in normal persons after 24 hr. The maximum level was in the decreasing order of persons positioned at the nozzle part, hose, machine, and preparation of the formulation. The ratio of creatinine clearance to 4-nitro-*m*-cresool levels was especially high in persons who showed subjective symptoms. All the applicators wore masks or towels over the nose and mouth with the usual farming clothes. These measures were apparently inadequate to protect their health.

77-0067. Chandler, M. T. (Tanzania-Canada Beekeeping Project, P.O. Box 661, Arusha, Tanzania). **Reducing pesticide hazards to honey bees in tropical East Africa.** *PANS* 22(1): 35-42; 1976. (13 references)

The general principles and methods for minimizing harmful effects to bees of insecticides are presented, along with several examples taken from East African experience, in an effort to educate the insecticide user. The vast majority of bee poisonings occurs when insecticides are applied to crops during the blooming period. Less important causes are the drift of toxic chemicals, bees coming into contact with insecticide residues on plants, bees collecting insecticidal dusts with the pollen, and bees drinking

or touching contaminated water on the ground or foliage. The various major uses of pesticides in East Africa are examined and classified with respect to their threat to bees. These areas of usage include: tsetse control, malaria control, cotton pests, coffee pests, maize pests, pests of grain legumes, forest pests, and the use of herbicides. Various mechanical devices are available which will confine the bees to their hives during spraying times. The fact that beekeeping is an indispensible sector of the agricultural economy will aid in obtaining legislative protection for honey bees.

77-0068. Howells, D. J.; Hambrook, J. L.; Allenby, E. A. (Chem. Defence Establ., Porton Down, Salisbury, Wiltshire AP4 OJQ, England). **Uptake of some volatile alkyl methylphosphonofluoridates from the vapor phase by wheat plants.** *Pestic. Sci.* 7(4): 349-354; 1976. (33 references)

The uptake of cyclohexyl, isopropyl and 1,2,2-trimethylpropyl methylphosphonofluoridates from the vapor phase by growing wheat plants was studied. The compounds were absorbed through the leaves of the plants and were degraded in a manner similar to that following their uptake through the roots from hydroponic culture solution. The levels of the methylphosphonic acid derivatives in the plant extracts were influenced by the vapor concentration of the methylphosphonofluoridate, the period of exposure to the vapor, and the state of illumination of the plants, but were not markedly influenced by the chemical nature of the compounds. Likely mechanisms for the uptake are discussed and it is concluded that the main route of absorption involves the stomata. The studies suggest that growing plants can absorb and possibly have a "sink effect" for atmospheric organophosphorus contamination. (Author abstract by permission)

77-0069. Hosaka, Y.; Yamaura, A. (Sch. Cerebral Nerve Surg., Fac. Med., Chiba Univ., Chiba, Japan). [**Electroencephalograms in a case of acute fetal intoxication due to an organophosphorus pesticide.**] *Rinsho Noha (Clin. Electroencephalogr.)* 18(10): 655-656; 1976. (2 references) (Japanese)

The case of a 33-year-old man who swallowed 200 ml of 50% EPN in an attempted suicide and was hospitalized in a coma was reported. Symptoms were conspicuous miosis and sweating with pulmonary edematous signs. He was treated by airway clearance and gastric lavage and injection of 1 g of 2-PAM (pralidoxime) and 1 mg of atropine. The miosis was relieved; however, as consciousness improved, fasciculations of limb muscles continued. He died of systemic weakness with mucous, bloody stools, in spite of the disappearance of contractures and improvement of consiousness. On the fifth day of hospitalization when he was still comatose but knee-bending contractures, abnormal EEG appeared in total inductance consisting of spikes, sharp waves, and spike and wave complex of high amplitude with sudden appearance of bursts. On the twelfth day, when his consciousness was improved, no abnormalities in the EEG such as spikes and sharp waves were recorded. The findings in the EEG were interesting in relation to the clinical symptoms.

77-0070. Mori, S.; Onishi, Y.; Hoshi, M.; Fukuhara, N.; Tsubaki, T. (Dept. Neurol. Internal Med., Niigata Citizen's Hospital, Niigata, Japan). [**A case of polyneuropathy due to trichlorfon intoxication with abnormal muscle tissue.**] *Rinsho Shinkeigaku (Tokyo Clin. Neurol.)* 16(8): 594; 1976. (Japanese)

A abnormal muscle tissue was noted in one of two cases of polyneuropathy due to trichlorfon intoxication, charactized clinically by delayed onset with initial symptoms of pain in lower extremities. The tissue was precisely examined. The findings in the biopsy were the appearance of many foci of target type cells in atrophic fibers stained with DPNH-diaphorase, which were surrounded by an ordered granular substance stained red in color. Electron microscopy revealed cytoplasmic bodies and streaming of z-zones. These were presumed to be changes indicative of denervation or reinnervation.

77-0071. Holden, C. (Author address not given). **Mirex: Persistent pesticide on its way out.** *Science* 149(4262): 301-303; 1976.

The currently proposed settlement on the Mirex question calls for current Mirex registrations to be phased out over an 18-month period. The aerial spraying of the strong version of Mirex, called 4X bait, would have to be terminated by the end of 1976. Cancellation of the diluted form of Mirex, called Mirex 10:5, would go into effect at the end of 1977. Stocks of Mirex 10:5 would be permitted for selective ground application until June of 1978 only. Evidence against Mirex includes its carcinogenicity in mice and rats, its stability in the environment, and the fact that some of it degrades to the carcinogenic and neurotoxic pesticide Kepone (chlordecone). Mirex is supported because of its selectiveness and effectivenes against fire ants. The EPA reported a few months ago that up to 25% of the population living in sprayed areas may have Mirex stored in their bodies. It is doubtful that the Mirex question will be settled by facts alone. Emotions generated in a public that is becoming increasingly frightened by the loading of toxins into the environemnt has as much to do with closing down the Mirex program as does any fact. The question of what to substitute for Mirex is a big one.

77-0072. Quinones, M. A.; Bogden, J. D.; Louria, D. B.; Nakah, A. E. (Dep. Preventive Med. Community Health, Coll. Med. Dent. New Jersey, New Jersey Med. Sch., Newark, NJ 07103). **Depressed cholinesterase activities among farm workers in New Jersey.** *Sci. Total Environ.* 6(2): 155-159; 1976. (14 references)

Depressed cholinesterase levels among New Jersey migrant workers were investigated. Fifty-seven migrant farm workers in the southern counties of New Jersey

were screened for organophosphate pesticide exposure in late Augest of 1973 and mid August of 1974. The mean cholinesterase activity (international units at 30°C) was 4.9 for the migrant workers and 6.5 for controls. Six farm workers had activities below the lower limit of normal (3.6 IU) and one control was below the lower limit. These results suggest that the farm workers are experiencing depressed cholinesterase activity as a result of occupational exposure to organophosphate pesticides. No statistically significant difference was found between cholinesterase activities in Puerto Rican vs. non-Puerto Rican controls. Thirty-eight percent of the farm workers and only 17% of controls reported frequent or severe headaches. Nausea was noted in 27% of the workers and 9% of the controls. No statistically significant differences were noted in cholinesterase levels between those workers with symptoms and those without.

77-0073. Nisbet, I. C. T. (Author address not given). **Measuring cancer hazards: it takes a mouse to catch a rat.** *Technol. Rev.* 78(2): 8-9; 1975.

Recent restrictions of DDT, aldrin, dieldrin, and those pending on chlordane and heptachlor were brought about by the hazards these chemicals pose to human health. The hazard of cancer was the major cause in each case. The principal issue at hearings has been the induction of liver tumors in mice exposed to chemicals which are used in the environment, and the question as to whether the induction of these tumors in mouse liver has any relation to the possible induction of tumors in man. The notion that the mouse liver is labile and unpredictable rests on the fact that some strains of mice develop liver tumors spontaneously at a high and variable frequency. The finding that a chemical poses hazards to health is followed by a risk-benefit analysis to determine whether any or all uses of this chemical pose an unacceptable risk to humans. However, the hazard of cancer poses particular problems. There is no dose of an established carcinogen which is so low that it can be assumed to be without effect on susceptible individuals. It is felt that in the near future some decision will be made relating to the number of excess cancers in the human population is that acceptable as a reasonable risk.

77-0074. Johnson, R. P.; Huxtable, C. R. (Dept. Vet. Pathol., Univ Sydney, NSW 2006, Australia). **Paraquat poisoning in a dog and cat.** *Vet. Rec.* 98(10): 189-191; 1976. (8 references)

Two cases of paraquat poisoning in pets are presented. In one case the pet was a 3 1/2 yr old male Siamese cat; in the other case a 5 yr old male fox terrier. Both animals showed early signs of paraquat poisoning similar to those described in other species. The development of respiratory distress with radiographic evidence of pulmonary consolidation in the cat closely resembed the course of the less acute syndrome in man and experimental animals. Improvement followed the use of a corticosteroid, but whether this improvement was due to the drug is not certain. The dog showed clinical and pathological changes consistent with the acute prefibrotic form of the disease. Intensive treatment as described for humans is recommended in the first 24 hr, and the prognosis should be considered guarded for 3 to 4 weeks after ingestion. Both these animals were exposed to grass which had been sprayed with paraquat solution.

77-0075. Williams, B. M.; Thomas, A. I. (Vet. Investigation Cent., Carmarthen, Wales). **Metaldehyde poisoning in cattle.** *Vet. Rec.* 98(18): 358-359; 1976. (3 references)

A few cows wandered into a barn in which fertilizers were stored, but did not remain there for more than 10 to 15 min. The following morning 10 cows were dead. Autopsy showed congestion of the subcutaneous tissues with a slight edema at the base of the neck. Numerous hemorrhages were noted over the epicardium, and the lungs were congested and edematous. Submucosa of the fore-stomachs and the mucosa of the abomasum and duodenum were congested. Rumen contents had a pH of 6.0-6.5, and in both the rumen and reticulum there were unevenly distributed quantities of a bluish green granular material. No lesions were detected in the liver, spleen, or kidneys. Abomasal contents of two cows contained 1400 ppm and 500 ppm metaldehyde. The pellets of slug bait stored in the barn contained about 6% metaldehyde. The cattle weighing about 600 kg would have had to consume about 180 mg of metaldehyde or 6 1/2 lb of bait if the toxic dose for cattle is similar to that of sheep. Careful storage is urged, as apparently a lethal dose can be ingested in the matter of a few minutes.

77-0076. Meyer, T.; Aarbakke, J.; Scheline, R. R. (Dept. Pharmacol., Univ. Bergen, MFH-Bygget, 5016 Haukeland Sykehus, Bergen, Norway). **The metabolism of biphenyl. I. Metabolic disposition of ^{14}C-biphenyl in the rat.** *Acta Pharmacol. Toxicol.* 39(4): 412-418; 1976. (24 references)

The nature of biphenyl metabolites and their major routes of excretion were studied in the rat. Male albino rats were given ^{14}C-biphenyl (p.o. 100 mg/kg, 0.7-1.0 μCi). The extent of radioactivity excretion in the urine diminished greatly after 48 hr. The mean total excretion during the 96 hr period was 84.8% of the dose. The mean total 96 hr fecal excretion of radioactivity was 7.3%, of which 5.8% was detected in the first 24 hr. Only trace amounts of radioactivity were detected in expired air. After 4 days the total amount remaining in the animals was 0.6%, of which 0.1% was in peritoneal fat, 0.3% in gastrointestinal tract and its contents, 0.1% in skeletal muscles and 0.1% in the genital tract. Both acidic and phenolic metabolites of biphenyl were noted in the rat urine. The presence of amphoteric metabolites was also suggested. Therefore, biphenyl is converted through oxidative metabolic reactions in the rat to phenols and acids.

77-0077. Meyer, T.; Larsen, J. C.; Hansen, E. V.; Scheline, R. R. (Dept. Pharmacol., Univ. Bergen, Bergen, Norway). **The metabolism of biphenyl. III. Phenolic metabolites in the pig.** *Acta Pharmacol. Toxicol.* 39(4): 433-441; 1976. (17 references)

Phenolic metabolites of biphenyl were studied in the pig, the dose being 100 mg/kg, for each of several biphenyl compounds. The total urinary excretion of phenols in 4 days was 27.6% of the dose administered. Most of this total (19%) was 4-hydroxybiphenyl. Other metabolites included 2-hydroxybiphenyl and 4,4′-dihydroxybiphenyl, comprising 2.7 and 2.0%, resp., of the dose. Remaining metabolites accounted for less than 1% of the administered dose. The total 96 hr recovery from male pigs was 44.8% of the dose, while the corresponding value for the female pigs was 27.6%. No fecal excretion of phenolic metabolites was detected. This study showed that pigs are poor biliary excretors of hydroxylated biphenyls in comparison with the rat. The absence of the entero-hepatic component in the metabolism of biphenyl in pigs explains why the urinary excretion of biphenyl metabolites in a neomycin-treated pig was not decreased when compared to that found in normal animals. Quantitative differences in the species pigs and rats indicate that minor amounts of di- and tri-hydroxylated biphenyls were encountered in the pig in contrast to the rat. Also, 2-hydroxybiphenyl was a more important metabolite of biphenyl in the pig than in the rat.

77-0078. Meyer, T.; Scheline, R. R. (Dept. Pharmacol., Univ. Bergen, MFH-Bygget, 5016 Haukeland Sykehus, Bergen, Norway). **The metabolism of biphenyl. II. Phenolic metabolites in the rat.** *Acta Pharmacol. Toxicol.* 39(4): 419-432; 1976. (23 references)

Phenolic metabolites from biphenyl were studied in male albino rats who had been injected with doses of 100 and 400 mg/kg of various biphenyl compounds. The total amount of phenols in rat urine 96 hrs after biphenyl administration was 29.5%. The most prominent metabolites were 4-hydroxy- and 4,4′-dihydroxybiphenyl, with the latter being the main one. Several previously unknown metabolites of biphenyl were also detected. The new metabolites found were 3,4′-dihydroxybiphenyl, 3,4,4′-trihydroxybiphenyl and its 3- and 4-*O*-methyl ethers. The two monomethylated derivatives of 3,4-dihydroxybiphenyl, while previously reported in rabbits, have now been found also in rats. The amount of phenols of biphenyls origin in the 24 hr bile from rats was 5.2% of the dose, with 4-hydroxy-, 4,4′-dihydroxy-, and 3,4,4′-trihydroxy-biphenyl as major metabolites. These results indicate that biliary metabolites are subsequently reabsorbed only to an insignificant degree. The pattern of metabolites excreted in the 24 hr fecal studies were similar to the bile studies. In the feces phenolic metabolites were the main types of metabolites excreted.

77-0079. Capen, C. C.; Martin, S. L.; (Dept. Pathobiol., Coll. Vet., Med., Ohio State Univ., 1925 Coffey Rd., Columbus, OH 43210). **Hyperadrenocorticism in dogs.** *Am. J. Pathol.* 81(2): 459-462; 1976. (6 references)

Hyperadrenocorticism is studied in dogs as an aid to understanding the disease more fully in humans. In particular, investigations with the animal model may help develop a more effective medical treatment for Cushing's syndrome in man through the use of *o,p′*-DDD (TDE) or other adrenocorticolytic drugs. Cells of the zona fasciculata and zona reticularis are highly susceptible to the cytotoxic effects of *o,p′*-DDD, and clinical manifestations of cortisol excess in dogs can be rapidly reversed by relatively low doses, such as 50 mg/kg, given at weekly intervals.

77-0080. Koos, B. J.; Longo, L. D. (Dept. Gynecol. Obstet., Sch. Med., Loma Linda, CA). **Mercury toxicity in the pregnant woman, fetus, and newborn infant.** *Am. J. Obstet. Gynecol.* 126(3): 390-409; 1976. (152 references)

Reported cases of mercury poisoning in pregnancy are reviewed. On the basis of these studies it is concluded that all mercury compounds can cause fetal harm, but methylmercury has the greatest toxicity. Occupational exposure to mercury compounds and heavy consumption of contaminated fish appear to be the major sources of exposure for pregnant women. Metallic mercury is able to cross the placenta, while inorganic mercuric compounds appear less able to do so. Methylmercury compounds cross the placenta and accumulate in fetal tissues. Embryopathic and teratogenetic effects have been demonstrated in animals exposed to inorganic mercuric and methylmercuric compounds. Human fetal poisonings have also been reported. Mercury poisoning in pregnant women is primarily diagnosed via history, symptoms, and signs, whereas mercury levels of maternal blood and urine are of less diagnostic importance. Specific therapy for inorganic mercury poisoning includes BAL, penicillamine, and calcium disodium edetate. Methylmercury poisoning therapy is largely symptomatic although penicillamine and polythiol resins show promise. Suggested guidelines for mercury exposure include 0.01 and 0.02 mg/m^3 for mercury vapor and for inorganic and phenylmercuric aerosols, resp. Pregnant women should not be exposed to methylmercury compounds and should not eat more than 350 of fish/week.

77-0081. Simon, G. A.; Tirosh, M. S.; Edery, H. (Israel Inst. Biol. Res., Tel-Aviv Univ. Med. Sch., Ness Ziona, Israel). **Administration of obidoxime tablets to man.** *Arch. Toxicol.* 36(1): 83-88; 1976. (15 references)

Twenty-four male volunteers were given obidoxime tablets in quantities ranging from 1.84-3.58 g in a single dose, or 7.36 g divided into 4 equal doses. With the lowest dose, average peak plasma level of the drug was 1.9 μg/ml and after the highest single dose it was 5.6 μg/ml, both attained 1.5 h after administration. In the multiple-dosed individuals, plasma levels of the oxime increased gradually following each additional dose, reaching a peak

of 3.5 μg/ml after the last dose. Thirteen individuals complained of one or more of the following side effects: pallor, nausea, pyrosis, headache, generalized weakness, sore throat, and paresthesia of the face muscles. Activities of blood cholinesterase, glutamic oxalacetic transminase, glutamic pyruvic transaminase, as well as hematocrit values, heart rate, and blood pressure were not affected. It is postulated that due to the undesirable side effects, the general use of obidoxime tablets should not be recommended. However, prophylactic oral treatment with obidoxime could be considered for persons at high risk of organophosphate poisoning or when parenteral administration might not be feasible. (Author abstract by permission)

77-0082. Schenck, J.; Loeffler, W.; Weger, N. (Fed. Armed Forces Med. Coll., Dep. Toxicol. Pharmacol., Munich, Germany). **Therapeutic effects of HS-3, HS-6, benactyzine, and atropine in soman poisoning of dogs.** *Arch. Toxicol.* 36(1): 71-81; 1976. (24 references)

Investigations into the therapeutic properties of various combinations of the bispyridinium salts HS-3 and HS-6 and the cholinolytics atropine and benactyzine against soman poisoning in unanesthetized male beagles were performed. The most effective protection against soman poisoning was attained if both oximes were applied early i.m. 6 min after intoxication together with the cholinolytics. On the basis of clinical symptoms HS-6 proved to have a more intensive therapeutic effect than HS-3 upon early application. If HS-3 was applied early after s.c. intoxication with low concentrations of soman (up to 3 LD50), a significant protection or reactivation effect on serum cholinesterase was measured. When HS-3 was applied at the beginning of convulsions - generally 28 min after s.c. intoxication - it also raised the rate of surviving animals. The maximal blood levels for HS-3 and HS-6 were measured 20-30 min after i.m. injection; the half-life values of HS-3 and HS-6 in plasma were 45-60 min. (Author abstract by permission)

See also **77-0020** **77-0106** **77-0143**

77-0083. Hagedorn, J.; Hohler, W. (Chem. Lab., Univ. Freiburg, Freiburg/Brsg, Germany). **Reaktivierung phosphorylierter Acetycholinesterase (AChE): Quartaere Salze vinyloger Pyrindinaldoxime.** [**Reactivation of phosphorylated acetylcholinesterase (AChE): quaternary salts of vinylogous pyridinaldoximes.**] *Arzneim-Forsch.* 26(8): 1515-1517; 1976. (18 references) (German)

Application of the Wittig reaction to 4-pyridinecarboxaldehyde produces 4-β-formylvinylpyridine in 62% yield. The corresponding oxime can be quaternized with α,α'-bis-(cholomethyl)-ether to give a product analogous to obidoxime or with methyliodide to give a product analogous to pralidoxime. The toxogonin vinylog is inferior to obidoxime in ability to reactivate acetylcholinesterase inhibited by paraoxon, but is slightly superior to pralidoxime. The lowered efficacy of the vinylog is readily explained by the lower acidity of its oxime group. The pralidoxime vinylogs were virtually ineffective as cholinesterase reactivators. In this case the insertion of an ethylenic double bond between the pyridinium ring and the aldoxime group decreases the capacity for reactivation of phosphorylated acetylcholinesterase (AChE).

77-0084. Kacew, S.; Singhal, R. L. (Dept. Pharmacol., Fac. Med., Univ. Ottawa, Ottawa, Ontario, Canada). **Role of cyclic adenosine 3′:5′-monophosphate in the action of 1,1,1-trichloro- 2,2-bis- (*p*-chlorophenyl) ethane (DDT) on hepatic and renal metabolism.** *Biochem. J.* 142(1): 145-152; 1974. (52 references)

The effect of alterations in the cyclic AMP-adenylate cyclase- phosphodiesterase system in DDT action on hepatic and renal carbohydrate metabolism was investigated. Doses of exogenous cyclic AMP (10 mg/100 g) mimiced the action of DDT as it enhanced the activities of pyruvate carboxylase, phosphoenolpyruvate carboxylase, fructose 1,6-diphosphatase and glucose 6-phosphatase in both the liver and kidney cortex, elevated the concentration of blood glucose and urea and decreased the amount of hepatic glycogen. Theophylline treatment augmented the effects of a submaximal dose of DDT on serum urea and glucose as well as the key gluconeogenic enzymes in liver and kidney cortex. DDT added in vitro to liver and kidney homogenates caused significant enhancement of adenylate cyclase activity. Hepatic and renal slices from rats already treated with DDT showed increased ability to convert (^{3}h)adenosine into cyclic(^{3}h)AMP. Kidney-cortex slices taken from rats given caffeine and DDT produced an even greater amount of cyclic (^{3}h)AMP, but imidazole, propranolol and hydrazine prevented the DDT-stimulated rise in cyclic nucleotide production. Prostaglandin E_1 did not exert any significant effect on DDT-induced increases in cyclic (^{3}h)AMP synthesis from radioactive adenosine. These results support the theory that the DDT-induced alterations in carbohydrate metabolism of kidney and liver cortex may relate to an initial stimulation of the cyclic AMP-adenylate cyclase system in these tissues.

77-0085. Yoshida, T.; Suzuki, Y.; Uchiyama, M. (Pharm. Inst., Tohoku Univ., Aobayama, Sendai, Japan). **Effect of piperonyl butoxide on hepatic delta-aminolevulinic acid synthetase activity in mice.** *Biochem. Pharmacol.* 25(21): 2418-2420; 1976. (30 references)

Piperonyl butoxide is known to exert a biphasic inhibitory effect on hepatic drug metabolizing enzymes. The biochemical nature of the stimulation of hepatic ALA synthetase activity by piperonyl butoxide was examined and its implications were discussed. A significant increase in ALA synthetase activity was observed after i.p. administration of piperonyl butoxide to fasted male ddy mice at 100, 300, and 500 mg/kg body weight. In each case a peak value was reached in 16 hr after synergist treatment, the values corresponded to 2.3, 3.5, and 4.5 times that of the control levels for the three dose levels. ALA synthetase activity remained elevated for as much as 24 hr after piperonyl butoxide treatment. However, hepatic drug-metabolizing enzyme activity measured as aminopyrine *N*-demethylase activity was profoundly inhibited for 16 hr after synergist treatment and returned nearly to control levels in 24 hr. Pretreatment of mice with cycloheximide or hemin prevented to some extent the piperonyl butoxide-induced increase in ALA synthetase activity. The effect of hemin has been attributed to a feedback repressor effect on the enzyme in some studies, and thus the findings support the concept that the increased ALA synthetase activity was due to protein synthesis rather than activation of preexisting enzyme. Other explanations were also discussed.

77-0086. Bennett, P. N.; Davies, D. S.; Hawkesworth, G. M. (Dept. Clin. Pharmacol., Royal Postgrad. Med. Sch., London, England). **In vivo absorption studies with paraquat and diquat in the dog.** *Brit. J. Pharmacol.* 58(2): 284P; 1976. (4 references)

Paraquat and diquat absorption was studied in Greyhound dogs. After i.v. administration of tracer doses of (^{14}c)-paraquat (30-50 μg/kg), the plasma concentration-time curve was fitted to an exponential decline equation which allowed the kinetics to be characterized on the basis of a three-compartment open linear system. In fasting dogs the absorption of low doses of paraquat in 200 ml water was rapid, but incomplete, reaching a peak plasma concentration 75 min after dosing. Oral administration of 120 μg/kg resulted in 46-66% absorption in 6 hr; at doses of 2 mg/kg and 5 mg/kg, 22-38% and 25-28%, resp., were absorbed. The urine contained 70-90% of the administered paraquat after 6 hr time. Diquat (12 μg/kg) was only 10-20% absorbed in 6 hr and did not produce an early plasma peak. Propantheline (15 mg i.v.) administered 15 min. before an oral paraquat dose altered the plasma concentration, delaying the peak concentration by 3 to 6 hr, indicating that the stomach is not a major site of paraquat absorption. The dose dependent absorption of paraquat in the dog suggests facilitated absorption, perhaps in the small intestine, whereas the absorption of diquat may occur solely by passive diffusion.

77-0087. Chmielnicka, J.; Balcerska, I. (Dep. Chem. Toksykol., Akad. Med., 90-154 Lodz, Poland). **Wplyw nixkich dawek zaprawy nasiennej plynnej 08 (metylorteciocyjanoguanidyny) na poziom aktywnosci dehydrogenazy jablczanowe w surowicy krwi szczurow. [The effect of low doses of methyl mercury fungicides on the acitivity level of malate dehydrogenase in the serum of rats' blood.]** *Bromatol. Chem. Toksykol.* 8(4): 407-408; 1975. (3 references) (Polish)

Oral doses of 0.01% LD50 methyl mercury fungicides, containing 0.8% mercury in the form of methyl mercury cyanoguanidine, were given to female Wistar rats. This amount corresponds to 2.0 μg Hg/kg, daily. At invervals lasting several weeks, serum from the animals was collected from a caudal vein. The malate dehydrogenase (MDH) activity was measured. At the period of 6 weeks (i.e., after ingestion of 81 μg Hg/kg) there was a two-fold increase in MDH. After 3 months (after ingesting 189 μg Hg/kg) the activity of this enzyme had increased 3-fold in relation to the level in control animals. These findings were true for every rat exposed.

77-0088. Mlodecki, H.; Fortak, W.; Szadcwska, A.; Fraczek, S.; Graczyk, J.; Wejman, I. (Inst. Environ. Monit. Bioanal., 90-145 Lodz, Poland). **Badania toksycznosci dinokapu. Cz. 1. Toksycznosc ostra. [Toxicity studies on dinocap. I. Acute toxicity.]** *Bromatol. Chem. Toksykol.* 8(4): 373-386; 1975. (31 references) (Polish)

studied in mice, rats, and rabbits. In male mice the LD50 value was 49.5 mg/kg; for female mice the corresponding value was 56.6 mg/kg; for male rats 1,179.5 mg/kg; for female rats 1,102.5 mg/kg; and for male rabbits about 3000 mg/kg. A rather extensive degenerative and necrotic modification was noted in rat liver and kidney following dinocap administration in a single dose of about the LD50 value. However, only slight changes in rat stomach mucosa were noted. Irritation of the skin and the eye conjunctiva were noted in rabbits and guinea pigs.

77-0089. Chmielnicka, J.; Komsta-Szumska, E.; Gajda, S. (Dep. Chem. Toksykol., Inst. Environ. Monit. Bioanal., Akad. Med., 90-145 Lodz, Poland). **Zaburzenia aktywnosci niektorych enzymow w surowicy krwi szczurow pod wplywem podostrej i przewleklej ekspozycji na zaprawa nasienna rtecioorganiczna R-8. [Effect of subacute and chronic exposure to organomercuric seed dressing preparation R-8 on the activity of some blood serum enzymes in rats.]** *Bromatol. Chem. Toksykol.* 8(4): 399-405; 1975. (16 references) (Polish)

A study was made of the effects of an organomercuric seed dressing R-8, which has methylmercuricyanoguanidine as an active component, on some blood serum enzymes. Wistar rats were orally intoxicated with the agent for 90 days. A ten-fold increase was noted in malate dehydrogenase activity, a slight increase in glutamic-oxaloacetic and glutamic-pyruvic transaminase activities, an enhancement in glucosephosphate isomerase activity, and a slight decrease in leucine aminopeptidase activity in the blood serum of the test animals.

77-0090. Mlodecki, H.; Lasota, W.; Banaszczyk, B.; Lewgowd, T.; Osiecka-Smaga, H. (Dep. Bromatol., Inst. Environ. Anal. Bioanal., Akad. Med., 90-145 Lodz, Poland). **Wplyw fenitrotionu na enzymy szczurow w zatruciu podostrym. Cz. VI. Obserwacje frakcji bialkowych w surowicy krwi szczurow otrzymujacych fenitrotion i karmy o roznej zawartosci bialek. [Effect of fenitrothion on enzymes in subacute intoxicated rats. VI. Blood serum proteins picture in rats intoxicated with fenitrothion and fed a diet with different protein content.]** *Bromatol. Chem. Toksykol.* 8(4): 393-398; 1975. (4 references) (Polish)

Electrophoretic patterns were recorded on blood plasma protein samples collected from rats fed diet containing 26, 21 (standard) or 4.5% protein and intoxicated with fenitrothion at a level of 0.02 the LD50 value. In intoxicated rats fed a diet with increased protein content (26%), and in intoxicated rats fed a diet with reduced protein content (4.5%), the results indicated significant differences in albumin-globulin ratios. However, in intoxicated rats fed a diet with standard protein content (21%), no effects were noted on these parameters.

77-0091. Fabacher, D. L. (Toxicol. Lab., Dept. Entomol., North Carolina State Univ., Raleigh, NC 27607). **Toxicity of endrin and an endrin-methyl parathion formulation to largemouth bass fingerlings.** *Bull. Environ. Contam. Toxicol.* 16(3): 376-378; 1976. (3 references)

The exact toxicity of endrin and a 1.6 - 1.6 lbs/gal endrin-methyl parathion formulation to largemouth bass fingerlings was studied. The 24 and 48 hr LC50 values for endrin to bass fingerlings were 0.49 and 0.27 ppb, resp. The 24 and 48 hr LC50 values of the endrin-methyl parathion formulation were 0.48 and 0.37 ppb, resp. Fish treated with 0.1 ppb endrin or 0.1 ppb endrin-methyl parathion showed 40% mortality in both assays on the 20th day after initial exposure. Average endrin residues in 4 dead fish from each assay were 0.0115 ppm in the endrin assay and 0.0165 ppm in the endrin-methyl parathion assay. These results demonstrate that continuous concentrations of 1 ppb or greater of endrin in the aquatic environment should be lethal to largemouth bass fingerlings, if they do not die earlier as a result of other factors. Unless endrin is kept out of the aquatic environment, fish kills of largemouth bass and other species seem inevitable.

77-0092. Tabet, J. C. K.; Lichtenstein, E. P. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Degradation of ^{14}C-photodieldrin by *Trichoderma viride* as affected by other insecticides.** *Can. J. Microbiol.* 22(9): 1345-1356; 1976. (15 references)

Various soil fungi were tested for their capacity to degrade the insecticide [^{14}C]photodieldrin. Of nine species investigated, *Trichoderma viride* was the only one

which degraded the insecticide to an appreciable extent into water-soluble, non-insecticidal compounds within 4-5 weeks. These products amounted to 32-41% of the radiocarbon applied to the culture media. The degradation was a function of live mycelia, which metabolized the insecticide and excreted water-soluble compounds into the culture media. Since soils usually contain a mixture of pesticide residues, the effects of several chlorinated hydrocarbon insecticides on the capacity of the fungus to degrade [^{14}C]photodieldrin were studied. Thus, in fungal cultures treated with compounds structurally similar to photodieldrin, such as aldrin and dieldrin, only 4-17% of the applied radiocarbon was water-soluble and more photodieldrin remained. In controls, however, 35% of the applied radiocarbon was in the form of water-soluble products and less photodieldrin remained. The degradation of [^{14}C]photodieldrin by *T. viride*, with time, was associated with a continuous decline of hexane-soluble radiocarbon and a steady increase of water-soluble metabolites, which appeared in the fungal media. The amount of hexane-soluble radiocarbon in mycelia was directly related to the fungal mass. (Author abstract by permission)

77-0093. Licht, L. E. (Dep. Biol., York Univ., Downsview, Ontario, Canada). **Time course of uptake, elimination, and tissue levels of ^{14}C-DDT in wood-frog tadpoles.** *Can. J. Zool.* 54(3): 355-360; 1976. (10 references)

Rana sylvatica tadpoles were treated with 0.001 and 0.003 ppm [^{14}C]DDT (1,1,1-trichloro- 2,2-bis(*p*-chlorophenyl) ethane) at 15 and 21°C and the time course of uptake and residue levels in several tissues of contaminated tadpoles were studied. By 24 hr post treatment, highest concentrations of DDT were found in whole animals and in isolated tadpole tissues. After 80 hr DDT tissue levels began to diminish and fall slowly throughout the duration of the experiment. Liver and fat were the main sites for pesticide deposition. Tadpoles treated at 15°C retained higher tissue levels of DDT for longer periods, i.e., they lost DDT more slowly than tadpoles at 21°C. (Author abstract by permission)

77-0094. Suzuki, T.; Takeda, M. (National Inst. Hygienic Sciences, Min. Health and Welfare, Tokyo, Japan). **Microbial metabolism of *N*-methylcarbamate insecticides I. Metabolism of *o-sec*-butylphenyl *N*-methylcarbamate by *Aspergillus niger* van Tieghem.** *Chem. Pharm. Bull.* 24(9): 1967-1975; 1976. (12 references)

The metabolism of BPMC was examined in *Aspergillus niger* van Tieghem to illustrate the metabolic fate of *N*-methylcarbamates in soil. Unchanged BPMC was recovered along with *o-sec*-butylphenol, *o-sec*-butylphenyl carbamate, *o-sec*-methylacetonyl) phenyl *N*-methylcarbamate, *0-sec*-butylphenyl *N*-hydroxymethylcarbamate, *o*-(1-hydroxy- 1-methyl propyl)phenyl *N*-methylcarbamate, *threo-o*-(2-hydroxy-1-methylpropyl) phenyl *N*-methyl carbamate and *erythro-o*-(2-hydroxy- 1-methylpropyl) phenyl *N*-methylcarbamate, *o*-(1-hydroxymethyl propyl) phenyl *N*-methylcarbamate, *o*-(3-hydroxy- 1-methylpropyl)-phenyl *N*-methylcarbamate, and one unidentified product (UK1). The metabolites were isolated by thin-layer chromatography and gas-liquid chromatography, and characterized by ultraviolet, infrared, nuclear magnetic resonance, and mass spectral analyses. Hydroxylation of alkyl side chains seemed to be the most important process for transformation of this carbamate by *A. niger*. One enantiomer of BPMC may be more selectively transformed than the other.

77-0095. Suzuki, T.; Takeda, M. (National Inst. Hygienic Sci., Min. Health and Welfare, Tokyo, Japan). **Microbial metabolism of *n*-methylcarbamate insecticides. III. Time course in metabolism of *o-sec*-butylphenyl *n*-methylcarbamate by *Aspergillus niger* and species differences among soil fungi.** *Chem. Pharm. Bull.* 24(9): 1983-1987; 1976. (4 references)

Five fungi were isolated from soil of rice fields treated with BPMC. The course of BPMC metabolism by these fungi was examined using ^{3}H-labeled BPMC. All of the fungi shared the capacity for hydroxylation of the studied compound at the alkyl side chain. Metabolic degradation of BPMC by *Aspergillus niger* reached a maximum at 2 or 3 days incubation time and hydroxylation on the alkyl chain occurred at an early time in this process. Predominant distribution of the radiolabel was found in the fraction of neutral or phenolic metabolites including unchanged BPMC except in the case of *Cladosporium cladosporioides*. Total recovery of radioactivity in the medium of this compound was lowest and a considerable portion of the metabolites was represented by more acidic and polar substances. *Coniothyrium* sp. seemed to produce fairly large amounts of acidic and polar metabolites, and the distribution of ^{3}H in the polar fourth fraction of the medium was highest in the case of *Pencilliumfuniculosum*. In the case of the two *Fusarium oxysporum* strains employed about one third of the original BPMC was recovered unchanged, and an unknown metabolite was detected.

77-0096. Suzuki, T.; Takeda, M. (Natl. Inst. Hyg. Sci., Min. Health Welfare, Tokyo, Japan). [Microbial metabolism of *N*-methylcarbamate insecticides IV. New metabolites of *o*-sec butylphenyl *N*-methylcarbamate by *Cladosporium Cladosporioides.*] *Chem. Pharm. Bull.* 24(9): 1988-1991; 1976. (5 references)

Cladosporium cladosporioides, isolated from soil previously treated with BPMC, was incubated with BPMC for 11 days, and the culture liquid was analyzed for metabolites. The principal metabolites were *o-sec*-butylphenol, *o*-(1-hydroxy-1-methylpropyl) phenol, and a mixture of *threo-* and *erythro-o*-(2-hydroxy -1- methylpropyl)phenol. The formation of *o*-(2-carboxy -1-

methylethyl)phenyl *N*-methylcarbamate methyl ester was confirmed by mass spectrometry. The experimental findings to date reveal that BPMC is metabolized to newly identified phenols with hydroxylated side chains and to ω-carboxylic acids. However it is unclear whether hydrolysis of the carbamoyl group precedes the hydroxylation of the side chain or the reverse in microbial metabolism of BPMC.

77-0097. Sundstrom, G.; Hutzinger, O.; Safe, S. (Lab. Environ. Chem., Univ. Amsterdam, Amsterdam, The Netherlands). **The metabolism of chlorobiphenyls. A review.** *Chemosphere* 5(5): 267-298; 1976. (129 references)

This review summarizes the metabolic studies on chlorobiphenyls performed by the use of discrete isomers of chlorinated biphenyls. Mechanistic studies and techniques used in the work of structural elucidation of metabolites are considered. Present knowledge on the metabolic pathways of two types of compounds structurally related to the chlorinated biphenyls, unsubstituted biphenyl and chlorobenzenes, is reviewed.

77-0098. Viswanathan, R.; Klein, W.; Korte, F. (Inst. Oekol. Chem., Gesellsch. Strahlen Umweltforsch. mbH, Munich, Germany). **Contributions to ecological chemistry 130. Balance of the fate of Imugan-C-14 in rats upon long term feeding.** *Chemosphere* 5(5): 357-362; 1976. (6 references)

Female Wistar rats were used as models to study the storage, distribution, metabolism, and excretion of Imugan-C-14 in animals. The rats were given orally a daily dose of 50.9 μg or Imugan-C-14 for 20 days. Imugan was metabolized very quickly and at a high rate. A high percentage of hydrophilic products among the metabolites in the excreta, the high rate of excretion of the radioactive substance in urine and feces, and the low concentration of the radioactive substances found in the organs and tissues at the end of the experiment reveal that Imugan, if ingested by animals, is easily eliminated from their bodies. The liver contained the highest organ concentration of radioactivity in both sexes, probably indicating that Imugan is detoxicated in the liver before it is excreted.

77-0099. Crosby, D. G.; Wong, A. S. (Dept. Environ. Toxicol., Univ. California, Davis, CA 95616). **Photochemical generation of chlorinated dioxins.** *Chemosphere* 5(5): 327-332; 1976. (29 references)

Irradiation of chlorophenols and their derivatives was studied. Test compounds were dissolved in 1% aqueous NaOH at levels of 100-1000 mg/l and irradiated in a sunlight-simulating photoreactor or with outdoor summer sunlight. The results of these studies suggest that the alkaline character of many natural waters allows relatively acidic chlorophenols to occur in ionic form in the environment, even though they also are introduced in that form in several instances. Photonucleophilic mechanisms would permit photochemical generation of chlorinated dibenzodioxins if the phenol concentrations were high enough for the bimolecular reaction to proceed efficiently. The dioxins resulting from this situation should depend greatly on the rate of dioxin photolysis. The detection of hexachlorodioxin after irradiation of pure PCP in water suggests that the dioxins reported to occur in environmental samples may actually arise by photochemical generation as opposed to direct introduction.

77-0100. Bastomsky, C. H.; Solymoss, B.; Zsigmond, G.; Wyse, J. M. (McGill Univ. Clin., Royal Victoria Hosp., Montreal, Canada). **On the mechanism of polychlorinated biphenyl-induced hypobilirubinaemia.** *Clin. Chim. Acta* 61(2): 171-174; 1975. (19 references)

Bilirubin UDP-gluguronyltransferase activity in hepatic microsomes of rats, treated with PCB or DDT, was studied. Serum biliribin concentrations were also studied in congenitally jaundiced Gunn rats treated with these compounds and with a sulfonamide. Female Sprague-Dawley rats were used in the study. PCB, but not DDT, increased liver weight and both compounds increased microsomal protein concentration. DDT enhanced liver microsomal bilirubin UDP-glucuronyltransferase activity; PCB, however, was without effect on bilirubin glucuronidation. In spite of the effect on bilirubin UDP-glucuronyltransferase activity in normal rats, DDT had no effect on the elevated serum bilirubin concentrations in jaundiced rats. PCB, which did not affect glucuronyltransferase activity in normal rats, lowered serum bilirubin almost by half. A similar fall in Gunn rats was noted when they received a single injection of sulphadiazine 4 hr before.

77-0101. Mendoza, C. E.; Shields, J. B.; Augustinsson, K. B. (Food Res. Div., Chem. Safety Bureau, Food Directorate, Health Protect. Br., Natl. Health Welfare, Ottawa, Canada K1A OL2). **Arylesterases from various mammalian sera in relation to cholinesterases, carboxylesterases and their activity toward some pesticides.** *Comp. Biochem. Physiol.* 55:23-26; 1976. (14 references)

The distribution of arylesterase activity towards thiophenyl acetate (TPA) has been determined in blood sera obtained from man, monkey, guinea pig, sheep, dog, cat and rat. Serum esterase activities have been determined using butyrylthiocholine iodide, propionylthiocholine iodide, thiophenyl acetate, indophenyl acetate and *p*-nitrophenyl acetate as substrates. TPA hydrolyzing enzymes are predominant in the mammalian sera studied. The enzyme inhibitors used are *S*-methyl fenitrothion, fenitroxon, paraoxon, butacarb and eserine salicylate. The TPA esteraxes examined are generally resistant to organophosphorus pesticide and eserine salicylate inhibition. Ovine and cavian sera show high activities for both TPA and *p*-nitrophenyl acetate.

77-0102. Pohl, R. J.; Philpot, R. M.; Fouts, J. R. (Pharm. Branch, Natl. Inst. Environ. Health Sci., P.O. Box 12233,

Research Triangle Park, NC 27709). **Cytochrome P-450 content and mixed-function oxidase activity in microsomes isolated from mouse skin.** *Drug Metab. Disposition* 4(5): 442-450; 1976. (31 references)

The isolation of a microsomal preparation from mouse skin which contains AHH, 7-ethoxycoumarin deethylase, and aniline hydroxylase activities and cytochrome P-450 is reported. Spectral analysis was used to determine the contamination of the preparation by cytochrome oxidase and cytochrome P-420. Enzyme activities studied in the skin of Swiss-Webster CD-1 mice did not respond to topical application of 3-methylcholanthrene. Twenty-four hr after topical application of TCDD, microsomes from mouse skin had 50% greater benzpyrene hydroxylase and 7-ethoxycoumarin deethylase activity, and 4- to 8-fold greater activity of these enzymes was noted after 72 hr. Cytochrome P-450 content was increased in skin microsomes after 24 and 72 hr following TCDD treatment. Chlorate treatment of skin microsomes, followed by centrifugation, was able to remove the contaminating cytochrome oxidase. Quantitative and qualitative analyses of cytochrome P-450 difference spectra were made from the solubilized preparations.

77-0103. Gruger, E. H., Jr.; Hruby, T.; Karrick, N. L. (Northwest Fish. Cent., Natl. Mar. Fish, Serv., Seattle, WA 98112). **Sublethal effects of structurally related tetrachloro-, pentachloro-, and hexachlorobiphenyl on juvenile coho salmon.** *Environ. Sci. Technol.* 10(10): 1033-1037; 1976. (26 references)

Four groups of cohorts of juvenile coho salmon (*Oncorhynchus kisutch*) were fed 2,5,2′,5′ - tetrachlorobiphenyl, 2,4,5,2′,5′ - pentachlorobiphenyl, and 2,4,5,2′,4′,5′ - hexachlorobiphenyl together at combined total concentrations of 1, 2, and 12 parts per million in food pellets. Salmon fed 12 ppm chlorobiphenyls gained weight significantly (P K 0.05) faster during a one-month treatment than salmon in a control group. Whole body concentrations of the three chlorobiphenyls in the fish during a 72-day period indicated a possible steady-state condition for the chlorobiphenyls when administered at the concentration of 1 ppm, but not at 2 ppm or greater in the food. Biphenyls chlorinated in the 2,5- and 2,4,5-positions on the aromatic rings were accumulated to a similar extent in the fish. Rearrangement of chlorine atoms from the 2,5-positions to the 3,4-positions in isomeric tetrachlorobiphenyls resulted in an apparent decrease in the accumulation of the compound in young salmon. For the first time a pentachlorobiphenyl was found to cause enhanced activity of the hepatic aryl hydrocarbon hydroxylase system in treated fish. (Author abstract by permission)

77-0104. Miyamoto, J. (Res. Dep., Pestic. Div., Sumitomo Chem. Co., Ltd., Takarazuka, Hyogo, Japan). **Degradation, metabolism, and toxicity of synthetic pyrethroids.** *Environ. Health Perspect.* 14: 15-28; 1976. (46 references)

The degradation, metabolism and toxicity of synthetic pyrethroids are reviewed. These compounds undergo biodegradation in mammals, both oxidatively and hydrolytically. The (+)- or (±)-*trans* isomers of the chrysanthemumate ester of primary alcohols such as fenothrin, furamethrin, proparthrin, resmethrin, and tetramethrin are metabolized through hydrolysis of the ester linkage with subsequent oxidation and/or conjugation of the component alcohol and acid moieties. The corresponding (-)-*cis* enantiometers and chrysanthemumates of secondary alcohols like allethrin resist hydrolytic attack, and biodegrade through oxidation at various molecular sites. The rapid metabolic degradation, together with presumed incomplete absorption from the gastrointestinal tract, contributes to the low acute toxicity of synthetic pyrethroids. These compounds do not irritate or sensitize the skin. Inhalation and dermal toxicities are fairly low. Teratogenicity does not occur in rats, mice, or rabbits. They are not mutagenic on various bacterial strains. Subacute and chronic feeding of high amounts of these compounds results in histopathological changes in the liver of rats. No tumorigenicity has been noted. Present recommendations for usage offer sufficient safety margins to the human population. However, several of the compounds may be toxic to certain kinds of fish and arthropods.

77-0105. Elliott, M. (Dept. Insecticides Fungicides, Rothamsted Exptl. Station, Harpenden, Hertfordshire, AL5 2LQ, England). **Properties and applications of pyrethroids.** *Environ. Health Perspect.* 14: 3-13; 1976. (82 references)

The properties and applications of pyrethroids are reviewed. The characteristics of pyrethroids include an outstanding potency to insects, low toxicity to mammals associated with rapid metabolic breakdown, and adequate stability on plant surfaces even in bright sunlight. Even the more stable compounds are degraded rapidly in soil, and, if research continues at the present rate, within a few years synthetic pyrethroids should be available for controlling a wide range of domestic, veterinary, horticultural, agricultural and forest pests with very low rates of application. Where natural and synthetic pyrethroids have been used intensively, especially to control insects already resistant to most of the commonly used insecticides, resistance has developed to pyrethroids. Therefore, research on treatment regimes likely to minimize the rate of resistance development is essential.

77-0106. Fishbein, L. (Natl. Cent. Toxicol. Res., Jefferson, AR 72079). **Potential hazards of fumigant residues.** *Environ. Health Perspect.* 14: 39-45; 1976. (88 references)

The review highlights a small number of illustrative problem areas dealing with a spectrum of mutagenic and potentially mutagenic fumigant residues. The fumigants considered include: ethylene dibromide, 1,2-dibromo-3-chloropropane, ethylene oxide, *sym-*

dibromotetrachloroethane, 1,3-dichloropropene, dichlorvos, carbon tetrachloride, and methyl bromide. Their degradation products in foodstuffs and soil are also reviewed. Many of these compounds are alkylating agents and thus possess mutagenic properties either per se or via their metabolic and/or degradative products. A number of the commonly used fumigants are carcinogenic and/or hepatotoxic. An a priori consideration of the structure of a number of these chemicals also suggests their possible mutagenicity, particularly in activated systems. This is particularly relevant to 1,3-dichloropropene, perchloroethylene, trichloroethylene, and possibly acrylonitrile, which may all undergo epoxidation, as well as hydrolysis products of 1,3-dichloropropene.

77-0107. Matsumura, F.; Beeman, R. W. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Biochemical and physiological effects of chlordimeform.** *Environ. Health Perspect.* 14: 71-82; 1976.

Biochemical and physiological effects of chlordimeform were studied in higher animals, in arthropod species, and in mammals. The studies suggest that in the rat the monoamine oxidase (MAO) inhibitory action of chlordimeform plays a supportive part in inducing early excitation symptoms. The primary cause of the excitation could come from its direct action. At later stages of poisoning such a MAO inhibitory action may be significant as judged by its antagonistic action to reserpine. Chlordimeform may act also by blocking amine receptors, particularly in the last stages of severe poisoning. Such receptor blockade would cause sedation. In the American cockroach the chemical directly stimulates the heart in situ, acts synergistically with tryptamine in vivo, inhibits amino-*N*-acetyltransferase from cockroach head in vitro, causes accumulation of indolamines in cockroaches in vivo, and blocks the stimulation of adenylate cyclase by octopamine in the cockroach central nervous system in situ. It also inhibits tryptamine metabolism in whole mites in vitro.

77-0108. Choudhury, S. R. (Histochem. Lab., Dept. Anat., Coll. Med., Univ. Iowa, Iowa City, Iowa). **Sensitivity of carboxylesterases of rat serum to diethyl-*p*-nitrophenyl phosphate.** *Enzyme* 21(4): 349-356; 1976. (15 references)

E600 (parathion) inhibition of substrate hydrolysis by carboxylesterases of whole rat serum and by one of its purified isozymes have been recorded. A homologous series of *n*-alkyl aliphatic esters of α-naphthol with increasing acyl C-chain has been employed as substrates. Blood was obtained from male Wistar rats. The profiles of E600 inhibition demonstrated that the residual isozyme activity rose gradually with progressively higher substrates. Organophosphate sensitivity therefore varied inversely with the number of carbon atoms in the substrate acyl chain. This decline in inhibitor susceptibility and the rise in residual activity may reflect the isozyme's increasing reactivity with successively higher substrates. Due to the conditions of these experiments, the stoichiometry of inhibition could not be followed. However, the enzyme activities decreased with increasing amounts of E600, indicating that more and more enzyme was converted into inactive phosphorylated derivative. The reasons for the differences between this kinetic study and earlier electrophoretic studies are not clear. The finding of a disproportionately high degree of E600 sensitivity with substrates bearing odd numbers of C-atoms suggests that, under the inhibitor influence, the esterases are able to distinguish between acyl chains bearing odd and even numbers of C-atoms.

77-0109. Van Dijck, P. J.; Van de Voorde, H. (Public Health Lab., Katholieke Univ. Leuven, Belgium). **Biodegradation of methoxychlor and kelthane.** *Eur. J. Appl. Microbiol.* 2(4): 277-284; 1976. (11 references)

The biodegradation of kelthane (dicofol) and methoxychlor was studied, along with *p,p'*-DDT, endrin, dieldrin, aldrin, heptachlor epoxide, lindane, and HCB. Of these chemicals, kelthane and methoxychlor showed the lowest accumulation hazard in these tests. However, it is cautioned that these insecticides are not so extensively used as DDT and others. The amount of metabolites found from methoxychlor was low and recovery of the insecticide from a bacterial suspension was not possible. Methoxychlor biodegradation details are enumerated. Anaerobiosis, neutral pH, and a large number of bacteria are favorable conditions. Some reducing substances, however, may replace the anerobic conditions. Contact of bacteria with kelthane or methoxychlor liberates Cl-, but the amount does not correspond to the expected theoretical value. Dechlorination of the ethane portion of the molecule is suggested. The amount transformed is lowered by antiseptics added to the bacterial suspension and by autoclaving. Metabolites are not obtained under these conditions, which suggests that an active process is required in addition to a passive absorption phenomenon.

77-0110. Truhaut, R.; Chauvel, Y.; Anger, J. P.; Lich, N. P.; Van Den Driessche, J.; Guesnier, L. R.; Morin, N. (Univ. Rene Descartes Paris Cedex 06, France). **Contribution a l'etude toxicologique et pharmacologique de l'oxyde de tributyletain (OTBE). [Toxicologic and pharmacologic study of tributyltin oxide.]** *Eur. J. Toxicol.* 9(1): 31-40; 1976. (11 references) (French)

Toxicologic and pharmacologic studies were conducted on tributyltin oxide. A delayed toxicity of this compound was noted in acute experiments. The same finding was noted in sub-chronic studies. Most of the animals tested died after a great loss of weight. The pharmacologic study, using tributyltin oxide, showed that this compound depresses the central nervous system. However, the action on ortho and parasympathetic systems was slight and not specific. In the rat, rabbit, and dog, the effect noted was a fall in blood pressure as a result of

depression of the vascular smooth muscle. Animals died due to respiratory arrest by a central mechanism.

77-0111. Pelissher, M. A.; Albrecht, R. (Lab. Recherches de Biologie, Conservatoire National des Arts et Metiers, 75 141 Paris Cedex 03, France). **Teneur minimale du regime en lindane induisant les monoxygenases microsomales chez le rat. [Minimum dietary lindane content inducing microsomal monooxygenases in the rat.]** *Food Cosmet. Toxicol.* 14(4): 297-301; 1976. (21 references) (French)

The effects of lindane on the livers and kidneys of young male rats were studied. The rats were fed for 4 wk on a diet containing 0.2, 0.5, 20 or 120 ppm lindane. Aminopyrine *N*-demethylation, aniline hydroxylation and cytochrome P-450 levels were measured along with cytochrome b_5 levels in a preparation of hepatic microsomes. Lindane increased liver weight, and particularly kidney weight. The effective dose of the pesticide was below 20 ppm for increasing kidney weight. Lindane induced microsomal mono-oxygenases of the liver as well as the synthesis of cytochrome P-450 at dietary levels of 2-20 ppm. However, enzyme induction by the pesticide shows different characteristics according to the type of substrate. Acceleration in aniline metabolism resulted essentially from increased amounts of P-450, even though the rate of metabolism of aminopyrine was increased only in part by the excess of this cytochrome.

77-0112. Cohn, W. J.; Blanke, R. V.; Griffith, F. D., Jr.; Guzelian, P. S. (Dep. Med., Med. Coll. Virginia, Richmond, VA). **Distribution and excretion of kepone (KP) in humans.** *Gastroenterology* 71(5): 901; 1976.

Thirty-two male chemical workers, poisoned by chronic exposure to kepone in large quantities, demonstrated a newly recognized toxic syndrome consisting of nervous system, testes, and liver involvement. Liver histology in 12 patients showed increased fat, numerous dense bodies, and proliferated smooth endoplasmic reticulum. Kepone was present in high concentrations in liver and subcutaneous fat. The partition of kepone between fat and blood was 10-20 fold lower than that reported for other lipophilic chlorinated hydrocarbons. Kepone metabolites were not identified in tissues, urine, or stool. Excretion of kepone was negligible in urine and sweat. Primary elimination occurred via the feces at a mean daily rate of 0.075% of the estimated total body stores. However, fecal excretion accounted for only 10% of the biliary excretion of kepone estimated in 7 patients. Thus kepone may be converted in the intestine to unmeasured chemical species and/or undergo enterohepatic circulation. Experimentation demonstrated that cholestyramine may accelerate depletion of kepone from tissue stores, thus providing a means for detoxification of patients poisoned with kepone or perhaps with other organochlorine pesticides.

77-0113. Kirkeby, S. (Dept. Anat., Royal Dental Coll., DK-2100 Copenhagen, Denmark). **The activity of non-specific esterase in the thyroid epithelial cells of the guinea pig as influenced by various inhibitors and activators.** *Histochemistry* 48(1): 51-60; 1976. (14 references)

An attempt was made to classify the nature of the esterases of the thyroid gland by the use of different activators and inhibitors, and to compare the results obtained with previous corresponding histochemical as well as biochemical studies. The agents employed in the study were tri-*o*-cresylphosphate (TOCP), parachloromercuribenzoate (PCMB), arsanilic acid, *p*-nitrophenyl dimethyl carbamate, and bis *p*-nitrophenyl phosphate. The activity in the follicle cells was selectively inhibited by TOCP when α-naphthyl acetate was used as a substrate. Arsanilic acid (0.001 M) activated the follicle cells proper selectively, but when the concentration was raised to 0.01*M*, the effect was that of inhibition while the activity in the para-, inter-, and intra-follicular cells was not changed. These results allow no clear cut division of the esterases in the thyroid gland of the guinea pig.

77-0114. Vivekanandan, M.; Gnanam, A. (Dept. Biol. Sci., Madurai Univ., Madurai 625021). **Studies on the mechanism of action of amitrole on chloroplast development.** *Indian J. Biochem. Biophys.* 12(4): 374-378; 1975. (26 references)

The mechanism of action of amitrole was studied, particularly its specificity to chloroplast development, using intact plants as well as isolated mesophyll cells of *Canna*. Chloroplast development was arrested by 3-amino-1,2,4-triazole (AT) in young, expanding leaves of *Canna edulis* Ker. Chlorophyll and carotenoid contents all declined after the leaves had been sprayed with an aqueous solution containing 5m*M* AT. Pigment level reduction was more pronounced than that of cellular proteins. AT inhibited the photosynthetic carbon dioxide reduction in mature cells. The decline in the pigment development rate in expanding leaves parelleled the loss of photosynthetic ability of these cells. The cell lipid content was maximally lowered in AT-treated cells, as compared to nucleic acids and proteins. The ability of the cells to absorb and incorporate glycine, glucose, and acetate into lipid and terpenoid compounds in the presence and absence of AT was compared. AT inhibited the synthetic rate of both the lipids and chloroplast specific terpenoid derivatives. Extraplastidic terpenoid synthesis was unaffected, suggesting a possible compartmentalization of the metabolic pool derived from photosynthetic intermediates inside the chloroplasts. Possible mechanism of action of AT in preferentially blocking chloroplasts from developing by interfering with the photosynthetic carbon reduction of developing chloroplasts is discussed.

77-0115. Martin, W. L.; Rogers, R. W.; Essig, H. W.; Chambers, H. W.; Coons, L. B. (Mississippi State Univ., Mississippi State, MS 39762). **Influence of dietary treat-**

ment on rat carcass DDT residues and toxicity parameters. *J. Anim. Sci.* 43(4): 786-791; 1976. (16 references)

The edible portion of carcasses from two steers that had been fed cotton gin trash contaminated with DDT for a period of 217 days prior to slaughter was broiled and the broiled ground beef, less fat drippings, was fed to rats for 120 days. Carcass DDT residues of rats fed ground beef from steers that initially contained 7.55 ppm of DDT did not differ from those fed on carcasses originally containing 4.25 ppm. Addition of .5% choline chloride to ground beef diets did not change the total DDT residue in rat carcasses. Females retained more DDT residues than did males. Mixed function oxidase activity increased with ingestion of DDT rats fed all meat diets, but was lower than the mixed function oxidase activity in rats fed a control diet. No smooth endoplasmic reticulum proliferation was noted in the livers of rats fed DDT when compared to livers from rats fed no DDT.

77-0116. Poland, A.; Glover, E. (Dept. Pharmacol. Toxicol., Univ. Rochester Sch. Med., Rochester, NY 14642). **Stereospecific, high affinity binding of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin by hepatic cytosol. Evidence that the binding species is a receptor for induction of aryl hydrocarbon hydroxylase.** *J. Biol. Chem.* 254(16): 4936-4946; 1976. (38 references)

Evidence of a TCDD-binding species in the hepatic cytosol of C57BL/6J mice is reported. The *in vitro* binding characteristics of this hepatic cytosol species correspond closely to the properties predicted for the induction receptor based on the biological responses observed *in vivo*. The specific binding of (^{3}h)TCDD to hepatic cytosol had an equilibrium dissociation constant KD of 0.27 n*M* and a maximum binding capacity of 84 fmol/mg of cytosol protein. Much less high affinity specific binding of (^{3}h)TCDD was noted in hepatic cytosol from DBA/2J mice. The binding affinity of 23 halogenated dibenzo-*p*-dioxins and dibenzofurans for this hepatic cytosol-binding species closely correlated with the potencies of these compounds as inducers of hepatic aryl hydrocarbon hydroxylase activity. The polycyclic hydrocarbons that induce hepatic hydroxylase activity competed with (^{3}h)TCDD for hepatic cytosol binding, but phenobarbital, pregnenolone-16α-carbonitrile, and the steroid hormones had no specific binding. It is suggested that the hepatic cytosol species which binds TCDD is the receptor for the induction of hepatic aryl hydrocarbon hydroxylase activity, and that the mutation in nonresponsive mice results in an altered receptor with a diminished affinity for inducing compounds.

77-0117. Thompson, B. L.; Hashmi, A. A. (Dept. ntomol., Univ. Agr., Lyallpur, Pakistan). **The human dermal absorption of organophosphate pesticides.** *J. Pakistan Med. Assoc.* 24(11): 245-251; 1974. (49 references)

Recent studies on the dermal toxicity of the organophosphate pesticides and studies on the absorption of other organophosphate compounds including the nerve gases are reviewed. Four principal methods employed in the study of dermal absorption include: in vitro perfusion cell technique, radioactive disappearance from the skin, dose-response method, and excretion analysis. Factors which alter absorption include the dose of penetrant which reaches the skin, environmental conditions of the skin, and the type of skin involved. The structure of the chemical being studied and the effects of the solvent in which it is carried are important factors. The findings of absorption studies using pesticide spraymen are briefly reviewed. Work in needed in the areas of pesticide absorption by farm workers other than spraymen so that proper occupational health measures may be instituted and maintained.

77-0118. Brown, T. M.; Brown, A. W. A. (Pesticide Res. Cent., Michigan State Univ., East Lansing, MI). **Experimental induction of resistance to a juvenile hormone mimic.** *J. Econ. Entomol.* 67(6): 799-801; 1974. (7 references)

The induction of a 13-fold resistance by larval selection with methoprene applied to a strain of the northern house mosquito *Culex pipiens pipiens* L. is reported. The foundation stock was collected in September 1973 and was of base-line susceptibility to DDT, dieldrin, and malathion. Susceptibility levels of successive generations to the juvenile hormone (JH) minic were measured. With each successive generation the dosage-mortality regression line steepened, so that its extent eventually became restricted to 1 logarithmic cycle. The strain produced by selection was considered to have a 13-fold resistance ratio at the EC_{50} level; at the EC_{90} level, however, the resistance ratio was closer to 5-fold only. When the cross-resistance spectrum of the methoprene-selected strain was tested, the resistance extended in full to the related JH mimic hydroprene. However, the selection had not made the strain more tolerant to the unrelated mimic Stauffer R-20458. The selected strain showed a 1.7-fold cross-tolerance to malathion but no cross-tolerance to carbaryl. The strong cross-resistance shown to hydroprene points to the far greater importance of carboxyesterase hydrolysis than the oxidative *O*-demethylation as a possible resistance mechanism for the methoprene-selected strain, which is supported by the cross-tolerance found to malathion.

77-0119. Matsushita, T.; Arimatsu, Y.; Tomio, T.; Nomura, S. (Dept. Public Health, Kumamoto Univ. Med. Sch., Kumamoto, Japan). **Experimental study on contact dermatitis due to herbicides sodium chlorate and sodium 2,2-dichloropropionate.** *Kumamoto Igakkai Zasshi* (*Kumamoto Med. J.*) 28(4): 170-175; 1975. (18 references)

The mechanism of contact dermatitis caused by sodium chlorate and sodium 2,2-dichloropropionate was investigated. Mature Wistar rats and ddN mice were used in the study. Aqueous test solutions were injected s.c. in the back of the animals. Test substances included sodium chlorate, Chlorate-50, Chlorate-FE, Desolate AZ, sodium

chloride, sodium 2,2-dichloropropionate, and DPA. Test herbicides showed some irritating effect on the s.c. sites in the animals. The reactions were the same for mice and rats, and were in proportion to the concentration of chemical injected. The threshold limit values of primary irritating effect were examined by using the flank of the skin of guinea pigs. The threshold limit values for sodium chlorate and its preparations were almost 20% or more, whereas those of sodium 2,2-dichloropropionate and DPA were 10% or more. These results indicate that sodium chlorate, sodium 2,2-dichloropropionate and their preparations might cause contact dermatitis. A primary irritant type of dermatitis is induced by these herbicides, and an allergic mechanism may be important in the pathogenesis of contact dermatitis caused by them.

77-0120. Altavinyte, O.; Daciulyte, J.; Lugauskas, A. (Institute of Botany, Acad. Sci., Lithuanian SSR). **Biologicheskaya aktivnost' pochvy v protsese razlozheniya v nei solomy. 2. Vliyanie gerbitsidov i insektsidov na kolichestvo i aktivnost pochvennykh organizmov. [Biological activity of soil during straw humification process. 2. Effect of herbicides and insecticides on the densities and activity of soil organisms.]** *Liet. TSR Mokslu Akad. Darb., Ser C* 4(68): 47-56; 1974. (12 references) (Russian)

The effect of herbicides and insecticides on the density and activity of soil organisms was studied using soddy podzolized loamy sand, soddy podzolized sandy loam, and soddy gray sandy loam as the soil samples. In each pot of soil 50 g of straw were placed to serve as fertilizer, and 10, 20, 30 or 40 earthworms (*Allolobophora caliginosa* f. typica Sav.) were added. The activity of the earthworms was slowed down by naphthalene and sevin, as was also the activity of collembola and microorganisms. The chemical substances retarded straw disintegration and the positive effect of the earthworms on this process was only slight. Naphthalene slowed down straw disintegration by 15.0 - 29.4 and sevin slowed it down from 6.5 to 17.6%. Straw humification was not affected by sodium trichloracetate. The accumulation of vitamin B_{12} in the soil was stimulated by earthworms and the biosynthesis of this vitamin was also improved. As straw humification proceeds, the amount of vitamin B_{12} gradually increases in the soil. Only when the amount of straw not disintegrated was less than 20% of that present initially did the amount of vitamin B_{12} begin to decrease. Herbicides and insecticides differ in their effects on vitamin B_{12} biosynthesis. The chemical with the most negative effect of those examined was dipterex.

77-0121. Agosin, M. (Dept. Zool., Univ. Georgia, Athens, GA 30602). **Insect cytochrome P-450.** *Molec. Cell. Biochem.* 12(1): 33-44; 1976. (51 references)

Studies carried out with the monooxygenase system associated with microsomal membranes in order to more fully understand the function of cytochrome P-450 in insects are reported. Procedures to solubilize and partially purify its components from housefly microsomes are discussed. These involve solubilization with either Triton X-100 or sodium cholate, followed by either ammonium sulfate fractionation, Sephadex G-200, DEAE-Sephadex A-50 column chromatography or by ω-amino-*n*-octyl-Sepharose 4B affinity chromatography. The study provides evidence that microsomes of the Fc housefly strain contain two species of chromosome P-450, cytochrome P-450 and cytochrome P-450I. The latter (amounting to about 30% of the total cytochrome P-450 contents) appears to be induced by phenobarbital or naphthalene to an extent that shifts the maximum absorbance of microsomes to lower wavelengths in the CO-difference spectra. To what extent cytochromes P-450 and P-450I in the Fc strain may correspond to additional multiple forms is difficult to ascertain at present.

77-0122. Kudamatsu, A. (Agric. Chem. Res. Inst., Nihon Tokushu Noyaku Seizo Co. Ltd., Hino, Tokyo, Japan). **[Tokuthion, a new organophosphorus insecticide with low mammalian toxicity.]** *Jpn. Pestic. Inform.* 26: 14-17; 1976.

Information is presented on Tokuthion, a new type of organophosphorus insecticide. The unsymmetrical organophosphorus ester with a characteristic *n*-propylthione radical has a broader spectrum of activity than closely related compounds such as VC-13 and S-seven. Its toxicity to mammals, birds and fishes is low; however, its insecticidal activity on numerous insect species is equal or superior to conventional, highly toxic compounds. Tokuthion was highly effective against lepidopterous larvae and shows a good safety margin to beneficial insects and miscellaneous insects and miscellaneous insects due to its unique selective toxicity. It is quite effective against aphids, flies, leafrollers and worms which show cross-resistance to chlorinated hydrocarbons, carbamates, and other organophosphorus insecticides. The chemical has both stomach and contact poison action, but practically no systemic or vapor activity. It does not appear to accumulate in the food chain.

77-0123. Ishida, S.; Ida, M. (Nihon Kayaku Co. Ltd., Tokyo, Japan). **A new herbicide for paddy fields, kayaphenone granules.** *Jpn. Pestic. Inform.* 27: 11-14; 1976.

Kayaphenone, with its major ingredient methoxyphenone, has a high level of safety for the environment. Residue problems are nonexistent. Its displays a high activity against annual monocotyledonous weeds, annual dicotyledonous weeds, and perennial weeds. Kayaphenone is absorbed mainly through young shoots of weeds and induces chlorosis. The herbicidal efficiency is constant, irrespective of temperature, soil type, and water management conditions. Its residual activity lasts about 3 weeks. No harmful influence on the growth and harvest of rice plants has been noticed. Methoxyphenone has exceptionally low toxicity to warm-blooded animals. Bensulide is also rated as a low toxicity compound.

77-0124. Fukazawa, N. (Nihon Tokushu Noyaku Seizo Co. Ltd., Hino, Tokyo, Japan). **Clearcide (thiochlormethyl), a new selective herbicide.** *Jpn. Pestic. Inform.*,27: 15-19; 1976. (7 references)

Clearcide (thiochlormethyl) showed outstanding plant compatibility with rice and excellent control of paddy weeds at doses from 0.5 to 2.0 kg/ha of active ingredient. Clearcide displayed excellent PPI, pre- and post-emergence efficacies on various kinds of broad leaf weeds and certain grasses. It also shows excellent control of various perennial weeds, floating weeds, and algae at the recommended dosage of 0.5 to 1.0 kg/ha active ingredient. It can be used in combination with grass herbicides to extend control toward all important weeds in paddy rice. The toxicity to experimental animals is low in acute, subacute, and subchronic studies. Low toxicity toward rats, mice and rabbits has been demonstrated. A low order of toxicity toward fish was noted.

77-0125. Tsumura, T. (Nihon Noyaku Co. Ltd., Tokyo, Japan). **Fuji-one, A new systemic fungicide.** *Jpn. Pestic. Inform.* 27: 20-23; 1976.

Data on laboratory experiments and field evaluation tests on fuji-one, a new systemic fungicide for the control of blast disease on rice crops, are presented. Fuji-one, di-isopropyl 1,3-dithiolan-2-ylidanemalonate, was easily translocated from the leaves via the root system, being detected in the root system and the whole plant at 6 hr and 3 days, resp., after application to the third leaf. Fuji-one applied 7 days before the outbreak of leaf blast protected rice plants from blast attack for 2 months. The timing of Fuji-one application recommended for panicle blast control is in the range from 10 to 30 days before panicle emergence. Residues remaining in the product create no problems in meeting the tolerance levels specified. Acute toxicity is low for all mammals irrespective of the administration routes. Fuji-one does not affect birds or aquatic animals under practical conditions. No teratogenic or mutagenic effects were noted in appropriate tests. Fuji-one concentration in milk taken from cows during and after a 4-week feeding of the funigicide in the diet at the level of 500 ppm, always gave a residue value of less than 0.001 ppm in all samples.

77-0126. Hayashi, K.; Kimura, T.; Sugawara, T. (Fac. Fish. Sci., Mie Univ., Tsu, Mie, Japan). [**Organophosphorus degrading activity of seawater on the coast of Mie Prefecture.**] *Mie Daigaku Kankyo Kagaku Kenkyukiyo (Rep. Environ. Sci., Mie Univ.)* 1: 171-180; 1976. (15 references) (Japanese)

The phosphatase activity of seawater on the coast at Mie Prefecture was determined using *p*-nitrophenyl phosphate as the substrate to evaluate the degradation of organophosphorus contaminants such as pesticides which were emitted into the seawater. Using 4 kinds of culture medium (glucose-nitrate- phosphate, TCBS medium, ZoBell 2216E medium and sucrose medium), 35 strains of oceanic bacteria such as *Pseudomonas*, *Achromobacter*, *Vibrio*, *Acinetobacter*, *Micrococcus*, and *Brevibacterium* were isolated, and the phosphatases produced by these bacteria were examined. Almost all the activity was located within the bacterial cell when cultured. After adding a small amount of peptone to seawater and increasing the number of bacteria the phosphatase activity increased proportionally to the number of bacteria. The actual phosphatase activity of seawater (collected in Nov. 1975) depended on the number of bacteria, zooplankton and phytoplankton, and showed activity such that 0.5-0.9 microgram of atomic phosphorus was produced by 1 l of seawater at 20°C in 10 hr from *p*-nitrophenyl phosphate.

77-0127. Drudge, J. H.; Lyons, E. T.; Tolliver, S. C. (Dep. Vet. Sci., Kentucky Agric. Exp. Stn., Univ. Kentucky, Lexington, KY). **Activity of organophosphorus compounds against oral stages of *Gasterophilus intestinalis* and *Gasterophilus nasalis*.** *Am. J. Vet. Res.* 36(3): 251-253; 1975. (5 references)

Dichlorvos given to pony foals in feed at 37 mg/kg, trichlorfon given in feed and by stomach tube at 40 mg/kg, and trichlorfon-butonate given intragastrically at 43 mg/kg were 100% effective against experimentally induced infections of *G. nasalis* and *G. intestinalis*. Dichlorvos given intraorally to horses at 36 mg/kg was effective against naturally acquired parasitic infection; carbon disulfide given by stomach tube at 2.4 ml/45.45 kg was ineffective. Treatment took place when the parasitic larvae were in the migratory period in the mouth tissue of the ponies and horses.

77-0128. Dikshith, T. S. S.; Gupta, P. K.; Gaur, J. S.; Datta, K. K.; Mathur, A. K. (Indust. Toxicol. Res. Cent., Lucknow 226001, India). **Ninety day toxicity of carbaryl in male rats.** *Environ. Res.* 12(2): 161-170; 1976. (19 references)

Oral administration of carbaryl (200 mg/kg for 3 days a week) for a period of 90 days did not produce any overt toxicological signs in male rats. There were no significant histological changes in testes, epididymis, liver and kidney. Similarly, no marked biochemical changes were seen in testes, liver, and brain. The activity of acetylcholine esterase in blood of carbaryl treated rat was, however, found to be decreased. Carbaryl did not affect the fertility of male rat at 200 mg/kg up to 90 days. (Author abstract by permission of Academic Press)

77-0129. Weis, P.; Weis, J. S. (Dep. Anat., Coll. Med. Dent. New Jersey, Newark, NJ 07103). **Abnormal locomotion associated with skeletal malformations in the sheepshead minnow, *Cyprinodon variegatus*, exposed to malathion.** *Environ. Res.* 12(2): 196-200; 1976. (19 references)

When embryos of *Cyprinodon variegatus* were exposed to the organophosphate insecticide malathion at concentrations of 3 and 10 parts per million, skeletal malformations developed that were associated with behavioral changes. Fry continued the embryonic convulsive, uncoordinated movements and were therefore unable to swim. Although some of the fry with abnormal movements were morphologically normal, many developed a bent appearance, similar to scoliosis. The severity of the abnormality was greater at the higher concentration of malathion. It is hypothesized that inhibition of acetylcholinesterase was responsible for the abnormal movement of the fry, and that the abnormal movement was responsible for the bent appearance. Malathion at 1 ppm, and DDT or carbaryl at concentrations of up to 10 ppm had no gross effects on embryonic development or hatching of this species. (Author abstract by permission of Academic Press)

77-0130. Koller, L. D.; Exon, J. H.; Roan, J. G. (Sch. Vet. Med., Oregon State Univ., Corvallis, OR 97331). **Immunological surveillance and toxicity in mice exposed to the organophosphate pesticide, leptophos.** *Environ. Res.* 12(2): 238-242; 1976. (22 references)

Male Swiss Webster mice were fed the organophosphate pesticide, leptophos, in feed at concentrations of 0, 10, 100, and 500 ppm for 12 weeks. Signs of organophosphate poisoning were moderate to severe inhibition of serum cholinesterase and decreased body weight gains of leptophos-exposed mice. Primary and secondary immune responses as measured by hemolytic plaque assay of antibody forming cells were not significantly altered in mice receiving leptophos compared to the controls. Histologically, lesions were not observed in mice which consumed as much as 170 mg leptophos/kg body weight/day for 12 weeks. It is concluded that leptophos does not significantly affect antibody formation and that this pesticide is only slightly toxic to mice. (Author abstract by permission of Academic Press)

77-0131. Poland, A.; Kende, A. (Dep. Pharmacol. Toxicol. Chem., Univ. Rochester, Rochester, NY). **2,3,7,8-Tetrachlorodibenzo-*p*-dioxin: environmental contaminant and molecular probe.** *Fed. Proc. Fed. Am. Soc. Exp. Biol.* 35(12): 2404-2411; 1976. (66 references)

The chlorinated dibenzo-*p*-dioxins and dibenzofurans are formed as trace contaminants during the synthesis of a number of commercially important chemicals. The prototype compound of this group, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), is one of the most potent low molecular weight toxins and teratogens known, and its inadvertent dispersion in the environment has caused concern about the potential hazard to human health. In studying the biochemical effects of TCDD, it was found to be extraordinarily potent as an inducer of two hepatic enzymes: 1) δ-aminolevulinic acid synthetase, the initial and rate-limiting enzyme in heme synthesis, and 2) aryl hydrocarbon hydroxylase, a cytochrome P-450-mediated microsomal monooxygenase. Among a series of halogenated dibenzo-*p*-dioxins there is an excellent correlation between their toxic potency and their potency as inducers of these two enzymes. The administration of polycyclic aromatic hydrocarbons (e.g., 3-methylcholanthrene (MC)) to certain inbred strains of mice induces aryl hydrocarbon hydroxylase, while other inbred strains fail to respond; and the trait of aryl hydrocarbon responsiveness is inherited as an autosomal dominant. TCDD, about 30,000 times as potent as MC, induces all strains whether responsive or nonresponsive to MC; however, the responsive strains are more sensitive (ED50 1 nmole/kg) to TCDD than are the nonresponsive strains (ED50 ≥ 10 nmole/kg). The results suggest that the mutation in the nonresponsive strains results in a ligand binding site (an induction receptor) that has a diminished affinity for MC and TCDD. The correlation among the halogenated dibenzo-*p*-dioxins, between their potency as toxins and their potency as inducers of aryl hydrocarbon hydroxylase, is discussed in relation to various proposed mechanisms of toxicity. (Author abstract by permission)

77-0132. Knowles, C. O.; Johannsen, F. R. (Dep. Entomol., Univ. Missouri, Columbia, MO 65201). **Metabolism of promecarb in the rat.** *J. Econ. Entomol.* 69(5): 595-596; 1976. (2 references)

Promecarb insecticide was rapidly metabolized and eliminated when administered orally to rats. Over 90% of the dose were present in urine and feces by 96 hr, with the urine containing the vast majority of the radioactive material. Most of the radioactive material in the urine was water soluble; however, low levels of promecarb, isothymol, and several unidentified organosoluble metabolites also were present. Levels of radioactivity in selected tissues were low and did not exceed 0.02 ppm. (Author abstract by permission)

77-0133. Kleerekoper, H. (Dep. Biol., Coll. Sci., Texas A&M Univ., College Station, TX 77843). **Effects of sublethal concentrations of pollutants on the behavior of fish.** *J. Fish. Res. Bd. Canada* 33(9): 2036-2039; 1976. (19 references)

Due to dilution and dispersion of pollutants in the natural environment, chronic exposure to subacute concentrations of such substances is likely to affect a much larger number of species and individuals than exposure to acutely morbid or lethal concentrations. Evidence points to the behavioral toxicity of subacute concentrations of pesticides affecting general locomotor behavior and oriented responses to environmental variables in particular. Complex interaction of these variables also may occur

and the response to such interaction by fish may be affected by chronic exposure to organophosphate. Response modifications are often subtle and may require long-term monitoring. (Author abstract by permission)

77-0134. Rosenthal, H.; Alderdice, D. F. (Biol. Anst. Helgoland, Hamburg, Germany). **Sublethal effects of environmental stressors, natural and pollutional, on marine fish eggs and larvae.** *J. Fish. Res. Bd. Canada* 33(9): 2047-2065; 1976. (105 references)

Sublethal effects of environmental changes on marine fish eggs and larvae are reviewed within a framework of concepts supplied by Bartholomew (1964), Sprague (1971), and Selye (1952). Such effects are those a) elicited through application of stress at one level of organization or development, b) recognized through the appearance of altered structure or function at a later stage of development, and c) whose significance is fully manifested as lower survival potential at a further stage of development. A number of sublethal effects are marshaled in terms of type of biological response and inferred consequences. Data suggest that a variety of stress-stressor systems may trigger a limited number of organismic responses, often appearing to involve the same physiological and biochemical mechanisms. Most sublethal effects appear to be biochemical in origin, elicited through physical or chemical change, and expressed in terms of histological, morphological, physiological, or ethological response. A need is expressed for an expanded and more unified inquiry into the origin, recognition, and significance of sublethal effects.

77-0135. Addison, R. F.; Zinck, M. E.; Leahy, J. R. (Dep. Environ., Fish. Mar. Serv., Marine Ecol. Lab., Bedford Inst. Oceanogr., Dartmouth, NS B2Y4A2). **Metabolism of single and combined doses of ^{14}C-aldrin and ^{3}H-*p,p'*-DDT by Atlantic salmon (*Salmo salar*) fry.** *J. Fish. Res. Bd. Can.* 33(9): 2073-2076; 1976. (17 references)

Atlantic salmon (*Salmo salar*) fry were injected intramuscularly with ^{3}H-*p,p'*-DDT and ^{14}C-aldrin either alone or as a mixture at concentrations similar to those found in "naturally" contaminated fish; their rates of metabolism and clearance were then compared. ^{3}H-*p,p'*-DDT was cleared slowly from the fish: approximately 60% of the injected material remained 8 wk after injection. ^{14}C-aldrin was cleared much more rapidly, only 55% of the injected material remaining in the fish 1 day after injection and less than 10% remaining at the end of the experiment. ^{3}H-*p,p'*-DDT was dehydrochlorinated to *p,p'*-DDE: assuming an exponential rate of conversion, its half-life was 60 days. In constrast, 50% of the aldrin residues in the fish were epoxidized to dieldrin with 2 days. No interactions between the insecticides were observed, although aldrin apparently induced a slight increase in the fraction of total body weight accounted for by liver. (Author abstract by permission)

77-0136. Kinebuchi, H.; Konno, N.; Yamauchi, T. (Sch. Pub. Health, Fukushima Prefect. Med. Coll., Fukushima, Japan). [**Delayed neurotoxicity of leptophos (phosvel), an organophosphorus insecticide (preliminary report).**] *Nippon Koshu Eisei Zasshi (Jpn. J. Pub. Health)* 23(9): 509-514; 1976. (15 references) (Japanese)

Solvent was evaporated from 34% Leptophos EC to obtain a concentrated EC containing 64.2% active ingredient, *O*-methyl *O*-(4-bromo-2,5- dichlorophenyl) phenylphosphonothioate. The condensed EC was forcibly administered p.o. to 3 groups of female adult white leghorns at 50, 250, and 500 mg a.i./kg. Up to the eighth day all the hens showed no abnormal appearance, except that one of five hens given 500 mg/kg died on the 4th day, probably due to acute intoxication caused by residual solvent. On the ninth day all the hens at 500 mg/kg showed a similar symptom. The paralytic symptoms of the hens began from the toes and ascended. The hens which showed such paralysis died between the twenty-first and forty-fourth days. The cause of their death was considered to be paralysis of respiratory muscles, and there was a possibility of paralytic ileus. In spite of vigorous appetite just before death, all the paralyzed hens showed conspicuous loss of body weight as the paralysis progressed, and their body weight at the time of death became about half that before administration.

77-0137. Ando, M.; Wakisaka, I. (Dept. Environ. Health, Natl. Inst. Environ. Pollut., Tokyo, Japan). [**Induction and recovery of drug metabolizing enzymes in the liver due to *p,p'*-DDE.**] *Nippon Koshu Eisei Zasshi (Jpn. J. Publ. Health)* 23(10 Suppl): 610; 1976. (Japanese)

To establish the minimum concentration of *p,p'*-DDE in living organisms which induces the activity of liver microsomal drug metabolizing enzymes, seven groups of five female Wistar rats each were administered i.p. a rapeseed oil solution of *p,p'*-DDE at 0, 25, 100, 200, 400 and 600 mg/kg b.w. They were then injected s.c. with 25 mg/kg b.w. of pentobarbital and the sleeping times recorded. After complete recovery of enzyme activity, the concentrations of *p,p'*-DDE in serum, liver, and fat of rats was determined. The time length of pentobarbital sleep shortened by *p,p'*-DDE showed a constant rate of recovery without regard to the concentration of *p,p'*-DDE administered. There was a linear relationship between the maximum induced metabolizing activity and the logarithm of the amount of *p,p'*-DDE administered. After complete recovery, fairly high residues of *p,p'*-DDE were found in serum, liver, and fat. There was a linear relationship in the concentrations between liver and serum, and between liver and fat.

77-0138. Kada, T. (Dep. Induced Mutat., Nat. Inst. Genetics, Mishima, Japan). **Rec assay with cold incubation with and without metabolic reactivation in vitro.** *Mutat. Res.* 38(5): 340; 1976.

The rec assay, a repair test utilizing strains of

Bacillus subtilis, was found to be effective for the detection of new base-change and frameshift mutagens in food additives, pesticides, etc. A set of strains H17 Rec+ and M45 Rec- had the highest and widest sensitivity spectra for typical chemical mutagens and carcinogens. Usually two cultures were streaked first on the surface of broth agar, a disk containing drug was placed at the starting area, then the plates were incubated overnight at 37°C. The sensitivities of the assay were increased several times by first keeping the plates overnight at 4°C (permitting diffusion of drug in agar), then incubating overnight at 37°C. Sensitivity was also increased by using frozen cells rather than fresh. The total increase in sensitivity was 30-fold. Using the improved procedures, rec assay was performed with activation by rat liver homogenate in vitro. A portion of S9 mixture was spread on the agar plate surface prior to inoculation. Typical chemicals gave positive results only with S9.

77-0139. Moriya, M.; Kato, K.; Shirasu, Y.; Kada, T. (Inst. Environ. Toxicol., Kodaira-Shi, Tokyo, Japan). **Mutagenicity screening of pesticides in microbial systems. III. Fate of mutagenicity.** *Mutat. Res.* 38(5): 342; 1976.

The microbial mutagenic activities of several pesticides were reported at the last two JEMS meetings. The fate of mutagenic activities of captafol, captan, DDVP (dichlorvos), folpet, NBT and NNN was investigated when they were incubated with S-9 Mix or L-cysteine. The mutagenicity of captafol (vs. *Escherichia coli* WP2 hcr and TA 1535) disappeared on the addition of S-9 Mix or L-cysteine. The mutagenicity of NBT (vs. TA 1538) also disappeared during the same treatment. In contrast, however, the mutagenic activity of NNN (vs. TA 1538) was increased by the addition of S-9 Mix. The mutagenicity of NNN was not affected by the addition of L-cysteine. The mutagenic activity of DDVP against *E. coli* B/r WP2 did not disappear on the addition of S-9 Mix or L-cysteine, whereas its mutagenicity against TA 1535 at the same dose disappeared during the same treatment. (Author abstract by permission)

77-0140. Shirasu, Y.; Moriya, M.; Lienard, F.; Kato, K. (Inst. Environ. Toxicol., Kodaira-Shi, Tokyo, Japan). **Mutagenicity study on ethylenethiourea I. Microbial assay.** *Mutat. Res.* 38(5): 348; 1976.

Fungicidal ethylene-bis-dithiocarbamates are decomposed and metabolized into ethylenethiourea (ETU) both in plants and in animals. Recent studies revealed the carcinogenicity of ETU in rats and mice and its teratogenicity in rats. Seiler (1974) reported a weak mutagenicity in *Salmonella typhimurium* G 46. We conducted a series of mutagenicity tests on ETU. The results of microbial testing are reported in this paper. Our test system consisted of the rec assay and reversion plate assay procedures, using *Bacillus subtilis*, *Escherichia coli* WP2 *her*, *S. typhimurium* TA1535, TA1536, TA1537, TA1538 and TA100. Metabolic activation tests and host-mediated assays were also performed in rats and mice. The rec assay was completely negative even at high doses of ETU. The reversion plate assay was positive with 4 to 5-fold increase of revertants only when ETU was tested at high doses in strain TA1535. The metabolic activation test using S-9 Mix was negative with the strains used. Furthermore, negative results were obtained in the host-mediated assays using *S. typhimurium* G46. (Author abstract by permission)

77-0141. Kasai, T.; Sugimoto, T. (Biol. Res. Lab., Nihon Noyaku Co. Ltd., Nagano, Osaka, Japan). [**Toxicity and accumulation of Fuji-one in aquatic organisms.**] *Noyaku (Agric. Chem.)* 23(3): 38-41; 1976. (Japanese)

The effects of Fuji-one, a fungicide against *Pyricularia oryzae*, containing diisopropyl 1,3-dithiolan-2-ylidene malonate on aquatic organisms as well as its uptake, accumulation, and elimination from aquatic organisms were examined because of its application on rice plants in flooded field. TLm (48 hr) of the a.i. to goldfish, scarlet killfish, rainbow trout, and loach is 6.8, greater than 11.4, 6.8, and 15.2 ppm, respectively. After formulation into granules the TLm becomes a little smaller. After rearing carp for 3 weeks in an aqueous Fuji-one solution, no spinal curvature was observed and no abnormal change in blood conditions. In 1 ppm aqueous solution of Fuji-one, its content in the carp body showed a maximum of 94 ppm after 24 hrs; however, it showed no further increase, but rather a slight reduction. The content decreased by about 50% after 7 hr when the carp was transferred into pure water and the content decreased to the detectable level after 48 hr. In mud snail uptake was faster and elimination was still faster than in fish. In case of water flea in a 1 ppm aqueous solution of Fuji-one, the content in the body increased to the maximum level of 2.6 ppm without further increase. These findings show that the toxicity and accumulation of Fuji-one in aquatic organisms should not become problems.

77-0142. Tanaka, T. (Sect. Survey, Inst. Environ. Toxicol., Kodaira, Tokyo, Japan). [**Evaluation of genetic safety of agricultural chemicals.**] *Noyaku (Agric. Chem.)* 23(3): 34-37; 1976. (Japanese)

The mutagenicity of chemical substances including agricultural chemicals has been recognized as a social problem. Considerations are presented on mutagenesis testing and evaluation of the test results in the Mrak Report. Standards are proposed for evaluating the genetic safety of food additives and other chemicals; the Japanese protocol adopts standards similar to those in the Mrak Report. The method of evaluating the genetic safety of agricultural chemicals which is now used in the author's institute consists of first screening by Rec-assay using 2 strains of *Bacillus subtilis* and in the host-mediated assay using the mouse as the host. A reverse mutation test and a metabolic activation test using *E. coli* and *Salmonella typhimurium* of specified susceptibility are also carried out.

77-0143. Acuna, J. I.; Fernandez, J. A. G.; Rosales, C. M. A. (Dep. Farmacol., Sch. Med., Univ. Costa Rica). **Inconveniencia de la sobredosificacion con pralidoxima (PAM) como reactivador de colinesterasas. [Disadvantages of overdosages of pralidoxime (PAM) as a cholinesterase reactivator.]** *Acta Med. Costarric.* 18(2): 95-108; 1975. (13 references) (Spanish)

The effects of pralidoxime (PAM) in increasing doses for the treatment of dogs intoxicated with folidol were studied. When 50 mg/kg PAM were used, true and false cholinesterase reactivation was almost complete. Muscarinic and nicotinic symptoms of the intoxicated animals were completely antagonized when atropine was added to the above treatment. Similar advantages were obtained with the dose of 75 mg/kg of PAM, except that a sciatic neuromuscular blockade was observed for a few minutes. This blockade persisted through the whole experiment when 100 mg/kg of PAM were used. Therefore, an optimum dose of 50 mg/kg of PAM in the treatment of the folidol intoxicated dog was determined. Higher doses are not recommended due to the neuromuscular blockage aggravation, mainly in renal insufficiency, since pralidoxime is excreted through the kidney.

77-0144. Bakke, J. E.; Feil, V. J.; Price, C. E. (Metab. Radiat. Res. Lab., ARS, USDA, Fargo, ND 58102). **Replacement of a chlorine with a methylsulfonyl group in the metabolism of propachlor (2-chloro-*N*-isopropylacetanilide).** *Biomed. Mass Spectrom.* 3(5): 226-229; 1976. (7 references)

Rat and sheep urinary metabolites from propachlor in which the chlorine was replaced by a methylsulfonyl moiety were isolated and identified. Rats and sheep had been given single oral doses of (^{14}c)propachlor. The urine contained ^{14}C metabolites in which the chlorine was replaced by a methylsulfonyl group. Methylsulfonyl-containing metabolites were also isolated from the urine of rats given an intraperitoneal dose of the cysteine conjugate of (^{14}c)propachlor. This indicated that the methylsulfonyl-containing metabolites resulted from metabolic reactions subsequent to the mercapturic acid pathway.

77-0145. Turusov, V. S.; Chemeris, G. Y. (Oncol. Sci. Cent., Acad. Med. Sci., Moscow, USSR). **Modification of toxic effects of DMBA by DDT and DDE.** *Chem. Biol. Interact.* 15(3): 295-298; 1976. (6 references)

DDT and DDE are known liver enzyme inducers; their ability to prevent the adrenolytic and lethal effects of DMBA (dimethylbenzanthracene) was examined. White random-bred female rats were given DDT in sunflower oil by stomach tube at 1, 10, or 100 mg/kg body weight on each of three successive days. In one experiment DMBA was given at 30 mg per rat on the day after the last DDT administration. In another experiment DDE was given at 100 mg/kg and 30 mg of DMBA was given 1, 2, 3, 4, 6, 8, or 10 days thereafter. In one group the DDE was given 2 hr after DMBA administration. All the rats given DMBA alone died within three days. Only one rat in the lowest DDT dosage group died; all others given DDT survived. Diffuse or focal adrenal necrosis was weakened in the case of DDT pretreatment. Single treatment with DDE 1 to 8 days before DMBA administration considerably reduced mortality; 2/34 rats treated in this manner died, compared to 9/10 rats given DMBA alone and 3/5 given DDE 2 hr after DMBA. Adrenal weight increased relative to liver weight in DMBA-treated rats; this effect was reduced by DDT or DDE administration. The degree of structural damage in the DDE-treated animals was similar to that in the group given DMBA alone.

77-0146. Martson, I. V.; Badayeva, L. N. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic. Polymers Plastics, Kiev, USSR). **Funktsional'no-morfologichna kharakteristika gonadotoksichnoi dii khlorofosu. [Functional-morphological characteristic of the gonadotoxic effect of chlorophos.]** *Dopov. Akad. Nauk. Ukr. RSR, Ser.* B (4): 361-367; 1975. (16 references) (Ukrainian)

A dose of chlorophos (trichlorfon, 1.5 mg/kg) introduced into the stomach of the rat for 2 months produced a gonadotoxic effect which resulted in pronounced changes in the spermatogenesis (and ovogenesis) indices. Observations included a decrease in the spermatogenesis index and the total number of spermatogonia, an increase in the number of ducts with desquamated epithelium and of those with the 12th stage of meiosis, as well as a decrease in the number of primordial and maturing follicles. Morphological examination detected the early alterations in the functional systems of the animals with no explicit symptoms of intoxication and the damage to injury of reproductive function during prolonged exposure to small chlorophos doses.

77-0147. Molnar, J.; Molnar, A. M. (Orszogos Munka-es Uzemegeszsegugyi Intezet, Budapest, Hungary). **Szemirritativ anyogok heveny gyulladast okozo hatasanak mennyisegi ertekeleses patkanyok szemhejan. [Quantitative evaluation of acute inflammatory activity of ocular irritants on the eyelid in rats.]** *Egeszsegtudomany* 20: 156-160; 1976. (12 references) (Hungarian)

A method is presented for determining the acute inflammatory action of topically applied mucosal irritants. This method is based on rating the Evans blue uptake in the inflamed upper eyelid. The method is bias-free. Its sensitivity is proved by the slope of the concentration-action curve obtained with formaldehyde. Of the 7 pesticides tested, Safidon 20 ULV (prolate), Niticid 25 EC (propachlor), Balan EC (benefin), Basagran (bentazon), Badilin Rosenfluid (dodemorphtdodine), BASF Mehltaumittel (dodemorph), and Luprosil (propionic acid), all but Safidon 20 evoked marked inflammation. It is emphasized that the solvents share in this effect.

77-0148. Berencsi, G.; Fodre, Z. (Inst. Hyg. Epidemiol., Szeged Med. Univ., Szeged, Hungry). **Adatok a paraquat tudospecifikus hatasarol tekintettel tengeri malacok BCG-vel torteno oltasara. [Data on the lung-specific effect of paraquat with regard to the BCG vaccination of guinea pig.]** *Egeszsegtudomany* 20: 172-174; 1976. (3 references) (Hungarian)

In view of recent data indicating that BCG may be a pathogenic factor in the presence of certain adjuvants in rabbits and guinea pigs, the question of whether it is changed into a pathogenic factor in paraquat-pretreated guinea pigs was considered. The results of the testing were negative. BCG produced the usual tuberculin positivity but did not cause any detectable anatomical alteration during a 6 month period, in spite of the high sensitivity of guinea pigs to the agent in question.

77-0149. Matsueda, S.; Masuchi, Y. (Fac. Gen. Educ., Hirosaki Univ., Hirosaki, Aomori, Japan). **[Effect of cysteine on human blood cholinesterase inhibited by organophosphorus in vitro.]** *Eisei Kagaku (J. Hyg. Chem.)* 22(5): 271-274; 1976. (10 references) (Japanese)

Blood samples collected from healthy young students were reacted with parathion or methyl parathion (0.1 and μmole 0.9 ml blood) to inhibit serum and erythrocyte cholinesterase activity. To the reacted blood mixture an aqueous solution of cysteine was added and reacted at 25°C for 30 min. (0.1 ml of 2 m*M* cysteine for 0.1 ml of the reacted blood). The cholinesterase determination showed that the inhibited serum cholinesterase activity was not stored but was further inhibited by cysteine treatment; however, the inhibited erythrocyte cholinesterase was restored by the treatment. Thus cysteine apparently behaved simiarly to glutathione with respect to human erythrocyte cholinesterase, and behaved opposite to glutathione with respect to human serum cholinesterase. The mechanism of the former effect probably represents the activation of the enzyme.

77-0150. Wolthuis, O. L.; Clason-Van Der Wiel, H. J.; Visser, R. P. L. S. (Med. Biol. Lab. TNO, Rijswijk 2100, The Netherlands. **The dependence of the blood level of the oxime HS-6 on the severity of organophosphate poisoning.** *Eur. J. Pharmacol.* 39(2): 417-421; 1976. (10 references)

The effect of the level of the oxime HS-6 in the blood on the severity of organophosphate poisoning was studied. Atropinized anesthetized Wistar rats were injected i.v. with 4, 6, or 8 times LD50 doses of soman. Subsequent treatment with one dose of HS-6 (100 mg/kg, i.v.) delayed respiratory failure by 1 hr or more. Further postponement was obtained when an additional HS-6 infusion was given. Using the same infusion rate, HS-6 blood levels after 4 LD50 soman remained stationary, but they did rise after higher soman doses. The rise was greater, the higher the dose of soman. This rapid rise of blood oxime levels after high doses of organophosphate may seriously complicate therapy. If attempts are made to prevent reinhibition by repeated oxime injections or by using a depot preparation, one may run the risk of overdosing the patient with oxime, if the intoxication is severe. Therefore, the oxime dose used may have to be chosen in inverse relation to the severity of the intoxication.

77-0151. Zakirov, U. B.; Kadyrov, U. Z.; Volokhvyansky, E. A. (Dep. Pharmacol., Tashkent Med. Inst., USSR). **Vliyanie razlichnykh doz tetrametiltiuramdisul'difa na fermentoobrazobatal'nuyu tdnkogo kishechnika. [The effect produced by different doses of tetramethylthiuram disulfide on the enzyme-producing function of the small intestine.]** *Farmakol. Toksikol. (Moscow)* 39(2): 199-203; 1976. (11 references) (Russian)

A study was made of the effect of tetramethylthiuramdisulfide (thiram) on the activity of small intestine mucosa in rats. Various doses of the compound induced a fall in the monoglyceride-lipase and dipeptidase activities and a rise in the invertase alkaline-phosphatase and amylolytic activities. Introduction of the compound over a protracted period of time caused a decrease in the weight of the small intestine mucosa. When the compound was given at a dose of 1/50 LD50 over a period of 6 months, one month was required off the drug for the enzymic activity and the weight of the mucosa to normalize. When the drug had been given at a single dose of 1/3 LD50, 15 days were required before the conditions returned to normal.

77-0152. Kuchushev, E. Kh. (Dep. Pathol. Physiol., Kazan. Med. Inst., USSR). **Ob allergennom deistvii armina. [The allergenic effect of armine.]** *Farmakol. (Moscow) Toksikol.* 39(2): 220-221; 1976. (4 references) (Russian)

The allergic effect of armine was studied in guinea pigs. Armine was given s.c. in doses of 0.1, 0.01, 0.005, and 0.0005 mg/kg for 5 or 6 doses at 2 to 3 day intervals. A challenge dose, equal to the sensitizing one, produced an anaphylactic shock in a group of animals sensitized with single doses of 0.005 and 0.0005 mg/kg. A large number of positive reactions, including degranulation of mast cells, agglomeration of leukocytes, and passive skin anaphylaxis, secondary to immunological tests preceding the challenge dose, confirmed the allergic nature of the reactions.

77-0153. Kirk, G. R.; Jensen, H. E. (Dep. Anat.-Physiol., Coll. Vet. Med., Univ. Missouri, Columbia, MO 65201). **Toxic effects of *o,p'*-DDD in the normal dog.** *J. Am. Anim. Hosp. Assoc.* 11(6): 765-768; 1975. (12 references)

Ten adult mongrel dogs received *o,p'*-DDD (TDE) tablets (50 mg/kg) daily for varying lengths of time. All but two dogs appeared healthy during treatment; two animals became weak and sluggish after several months of treatment and one died following 124 days of treatment. The adrenal cortices of all but one dog were necrotic, vacuolated, and invaded by lymphocytes. The capsules of all adrenal glands were thickened, whereas the adrenal cortex

in nine dogs was reduced to about half the normal thickness. The zona fasciculata and zona reticularis in the nine affected dogs were markedly disorganized and degenerated. Minute foci resembling hemorrhagic lesions were noted on the retinas of five dogs, although no retinal lesions could be identified on tissue sections. The data suggest that *o,p'*-DDD may produce retinal changes.

77-0154. Koeda, T.; Odaki, M.; Sasaki, H.; Yokota, M.; Niizato, T.; Watanabe, H.; Kawaoto, H.; Ito, T.; Watanuki, T. (Cent. Res. Lab., Meiji Seika Co., Yokohama, Kanagawa, Japan). [**Studies on the toxicity of phenazine-5*N*-oxide. Part 1. Acute and chronic toxicology tests on mice.**] *Oyo Yakuri (Appl. Pharmacol.)* 12(3): 465-482; 1976. (10 references) (Japanese)

The acute oral toxicity of phenazine-5*N*-oxide, a fungicide used against *Xanthomonas oryzae* on rice plants, was studied in ICR-JCL albino mice of both sexes; the fungicide was suspended in water with 5% gum arabic. Based on the 7-day mortality, the LD50 was determined to be 5500 and 5700 mg/kg in male and female mice respectively. The treated mice excreted yellowish brown urine, and their hair color changed to yellow, with body weight losses in those that died. To test the chronic toxicity, phenazine-5*N*-oxide was mixed with diet at levels of 12.5, 125, 1250, and 2500 ppm, respectively, and ICR-JCL albino mice of both sexes were fed this diet continuously for 96 weeks. All mice fed with diet containing more than 1250 ppm of the fungicide excreted yellowish brown urine, and their hair changed to a yellow color. During and at the end of feeding, the body weight and food intake showed no difference from those of controls. Elevated BUN and degeneration of renal tubular epithelial cells were observed in mice fed diet containing more than 125 ppm. Based on these results, the maximum no-effect dose of phenazine-5*N*-oxide in the mouse was assumed to be 12.5 ppm in the daily diet.

77-0155. Koeda, T.; Odaki, M.; Sasaki, H.; Yokota, M.; Niizato, T.; Watanabe, H.; Kawaoto, H.; Watanuki, T. (Centr. Res. Lab., Meiji Seika Co. Yokohama, Kanagawa, Japan). [**Studies on the toxicity of phenazine-5*N*-oxide. Part 2. Acute and chronic toxicology studies on rats.**] *Oyo Yakuri (Appl. Pharmacol.)* 12(3): 483-499; 1976. (11 references) (Japanese)

The acute oral toxicity of phenazine-5*N*-oxide, a fungicide used against *Xanthomonas oryzae* on rice plants, was studied on Wistar rats of both sexes. The fungicide was suspended in water with 5% gum arabic. Based on 7 day mortality rate, the LD50 was determined to be 6600 and 7000 mg/kg for male and female rats, respectively. The rats excreted urine of a yellowish brown color and their hair color changed to yellow, with body weight loss in the animals that died. To examine the chronic toxicity, phenazine-5*N*-oxide was mixed with daily diet at levels of 12.5, 125, 1250 and 2500 ppm, respectively, and the mixture was administered to groups of Wistar rats continuously for 100 weeks. All rats fed diet containing more than 1250 ppm excreted urine of a yellowish brown color, and their hair color changed to yellow. During the feeding period, the body weight, food intake, and water intake showed no difference from those of controls. Histopathological examination revealed degeneration of epithelial cells of the renal tubules and pyelonephritic changes in the groups fed with more than 125 ppm. Based on these findings, the maximum no-effect dose was assumed to be 12.5 ppm in the rat.

77-0156. Tanaka, K.; Kurihara, N.; Nakajima, M. (Dep. Agric. Chem., Radioisotope Res. Cent., Kyoto Univ., Kyoto, Japan). **Metabolism of lindane in house flies: metabolic desaturation, dehydrogenation and dehydrochlorination, and conjugation with glutathione.** *Pestic. Biochem. Physiol.* 6(4): 392-399; 1975. (27 references)

The in vivo and in vitro metabolism of lindane was studied in house flies. For the in vivo studies lindane (0.12 μg/fly) was applied topically to the thoraces of 4000 house flies. In the lindane-treated flies, a *cis*-dehydrogenated metabolite, (36/45)-hexachlorocyclohexene, was identified by gas-liquid chromatography and mass spectrometry. In vitro studies showed that in the presence of NADPH, the microsomal fraction of house flies converted lindane to three hexane-soluble metabolites. Piperonyl butoxide, SKF-525A, and carbon monoxide inhibited this conversion. The metabolites were identified as (36/45)-hexachlorocyclohexene, (36/45)- and (346/5)-pentachlorocyclohexene (PCCHE). The metabolites, along with lindane, were excellent substrates for the reaction with the postmicrosomal fraction in the presence of glutathione. The reaction with lindane-d_6 showed significant deuterium isotope effect (6.82), but the reaction with (36/45)-PCCHE-d_5 did not (1.18). It is suggested that enzymatic conjugation with glutathione occurs at the stage of PCCHE.

77-0157. Reinbold, K. A.; Metcalf, R. L. (Inst. Environ. Studies, Univ. Illinois, Urbana, IL 61801). **Effects of the synergist piperonyl butoxide on metabolism of pesticides in green sunfish.** *Pestic. Biochem. Physiol.* 6(5): 404-412; 1976. (11 references)

Piperonyl butoxide (PB) was used as an inhibitor of the MFO enzymes to study their effect on the degradation pathways and rates of the ^{14}C-radiolabeled pesticides methoxychlor, aldrin, and trifluralin in green sunfish, *Lepomis cyanellus*. The epoxidation of aldrin to dieldrin, *O*-dealkylation of methoxychlor, and *N*-dealkylation of trifluralin were inhibited by piperonyl butoxide, resulting in higher levels of total radioactivity in animals exposed to the combination compared to those exposed to pesticide alone. A greater proportion of the total radioactivity in the fish extract occurred as the parent compound when piperonyl butoxide was present, compared to metabolites than was found in fish exposed to the pesticide alone. Piperonyl butoxide increased the proportion of parent

compound 8 times for methoxychlor, 17 times for aldrin, and 15 times for trifluralin after 16 days of exposure. Thus this study revealed the dramatic effect of the multifunction oxidase inhibitor piperonyl butoxide in preventing detoxication of three pesticides in the green sunfish.

77-0158. Muecke, W.; Menzer, R. E.; Alt, K. O.; Richter, W.; Esser, H. O. (Agrochem. Div., Ciba-Geigy Ltd., Basel, Switzerland). **The metabolism of chlorotoluron in the rat.** *Pestic. Biochem. Physiol.* 6(5): 430-441; 1976. (16 references)

The metabolic fate of chlorotoluron was studied in male and female rats of the SIV 50 strain. In balance studies four animals of each sex received a single dose of 2.6 mg/kg (male) and 2.2 mg/kg (female). In the other studies 8 males each received a single dose of 2.6 mg/kg, 11.1 mg/kg, 52.2 mg/kg, or 102.6 mg/kg chlorotoluron. After a single oral dose the radioactivity was preferably excreted in the urine. Of the 11 urinary metabolites isolated, 9 were structurally identified. *N*-Demethylation and stepwise oxidation of the ring methyl group to hydroxymethyl and carboxyl derivatives were the major metabolic mechanisms. Both proceeded simultaneously, allowing the isolated metabolites to show all combinations of *N*-demethylation and ring methyl group oxidation in their structures. One metabolite, an *N*-formyl derivative, was probably an intermediate product of demethylation. In rats fed doses higher than 50 mg/kg, the urine contained 3 additional metabolites with different degrees of *N*-dealkylation, the ring methyl group of which was transformed to a methylthio methyl group. The feces contained metabolites of the same type as the urine. A metabolic pathway of chlorotoluron in the rat is presented.

77-0159. Sjoblad, R. D.; Minard, R. D.; Bollag, J. M. (Lab. Soil Microbiol., Dept. Agronomy, Pennsylvania State Univ., University Park, PA 16802). **Polymerization of 1-naphthol and related phenolic compounds by an extracellular fungal enzyme.** *Pestic. Biochem. Physiol.* 6(5): 457-463; 1976. (12 references)

Attempts were made to characterize compounds which were formed by the partially purified enzymatic fraction from *Rhizoctonia praticola*. An extracellular phenol oxidase was isolated from the culture filtrate by gel filtration on Sephadex G-200. The enzyme catalyzed the polymerization of 1-naphthol to dimeric, trimeric, tetrameric, and pentameric compounds determined by mass spectrometry. Identified compounds included: 4,4′-bis-1-naphthol, phenol, *o*-methoxyphenol (guaiacol), *p*-methylphenol (*p*-cresol), 2,6-dimethoxyphenol, and 1,3- and 1,5-dihydroxynaphthalene. The results of this study with 1-naphthol, an established intermediate in carbaryl degradation, focus attention on possible polymerization of xenobiotic compounds by phenol oxidases. Possible impact on environmental pollution through the formation of molecules which are very resistant to biological attack must be considered.

77-0160. White, I. N. H.; Verschoyle, R. D.; Moradian, M. H.; Barnes, J. M. (MRC Toxicol. Unit., Med. Res. Council Lab., Woodmansterne Rd., Carshalton, Surrey, England). **The relationship between brain levels of cismethrin and bioresmethrin in female rats and neurotoxic effects.** *Pestic. Biochem. Physiol.* 6(5): 491-500; 1976. (15 references)

Brain concentrations of cismethrin and bioresmethrin were determined following their administration to rats to discover any possible correlation either with the onset of tremors or with the death of the animal. Female albino Porton rats were used for the study. Toxicity of cismethrin decreased as the environmental temperature was raised. Acute oral LD50 values increased from 157 mg/kg at 4°C to 197 mg/kg at 20°C and to more than 1000 mg/kg at 30°C. When given i.v., cismethrin was much more toxic with an LD50 dose of 4.5 mg/kg. Environmental temperatures did not alter this value. Cismethrin caused tremors in rats when brain levels of 0.5-1.0 μg/g were reached, regardless of environmental temperature or route of administration. Brain concentrations of 3.9 - 5.1 μg/g were reached at death, suggesting that accumulation of cismethrin by the brain could serve as a model for the nervous system as a whole. Bioresmethrin was about 50 times less toxic than cismethrin, causing tremors when brain concentrations were 4-5 μg/g, and death at 25-35 μg/g. Plasma esterases were equally active in hydrolyzing cismethrin and bioresmethrin, while liver microsomal esterases hydrolyzed bioresmethrin over 10 times more rapidly than cismethrin. The lower toxicity of bioresmethrin was due to its faster metabolism and to an intrinsicially lower toxicity at the critical site of action in the nervous system.

77-0161. Mayer, R. T.; Burke, M. D. (Vet. Toxicol. Entomol. Res. Lab., ARS, USDA, College Station, TX 77840). **Albumin and cytochrome P450 binding characteristics of juvenile hormone and its analogs.** *Pestic. Biochem. Physiol.* 6(4): 377-385; 1976. (29 references)

The binding characteristics of the juvenile hormone (JH) and two analogs (JHA) to bovine serum albumin and hepatic microsomal cytochrome P450 are reported. The analogs studied were isopropyl (2E, 4E)-11-methoxy-3,7,11- trimethyl-2,4- dodecadienoate and (E)-4- [(6,7-epoxy-3,7- dimethyl-2- nonenyl)- oxyl]- 1,2-(methylenedioxy) benzene. Bovine serum albumin and rat hepatic microsomal cytochrome P450 bound the JH and the JHA with affinity constants ranging from 10^5 to $10^6 M$. Thermodynamic calculations suggest that the binding of all three compounds was electrostatic and that the size of the ether and ester substituents greatly influences the binding to proteins. JH and JHA all formed spectrally apparent Type I complexes with oxidized cytochrome P450. One of the JHA formed a spectrally observable product adduct with reduced cytochrome P450. The product complex may contribute many of the hormonal effects observed for this compound.

77-0162. (Dept. Entomol., Div. Toxicol. Physiol., Univ. California, Riverside, CA 92502). **Metabolism of *O,O*-dimethyl *S*-[α-(carboethoxy)benzyl] phosphorodithioate (phenthoate) in the white mouse and house flies.** *Pestic. Biochem. Physiol.* 6(4): 367-376; 1976. (15 references)

The metabolism of ^{14}C and ^{32}P labels of phenthoate in the white mouse, susceptible house flies, and flies resistant to the closely related organophosphorus insecticide dimethoate was studied. Phenthoate was metabolized rapidly in the white mouse with the major portion of the administered radioactivity appearing in the urine within 24 hr after treatment. Metabolites found in the feces or urine included: demethyl phenthoate, demethyl phenthoate oxon, phenthoate acid, demethyl phenthoate oxon acid, and *O,O*-dimethyl phosphorodithioic and phosphorothioic acids. Penetration of phenthoate was similar in both the susceptible (SNAIDM) and resistant (Rd) strains of house flies. Thus penetration is not a significant factor contributing to the 10-fold greater tolerance exhibited by the Rd strain to phenthoate. Distinct differences in the metabolism between the two strains were not readily discernible. Of possible significance was the recovery of 2-fold more phenthoate oxon from the susceptible than from the resistant strain. The selective toxicity of phenthoate between insect and mammal is attributed to the difference in the accumulation of the oxon.

77-0163. Niblett, P. D.; Ballantyne, J. S. (Dept. Zool., Univ. Guelph, Ontario, Canada). **Uncoupling of oxidative phosphorylation in rat liver mitochondria by the lamprey larvicide TFM (3-trifluoromethyl- 4-nitrophenol).** *Pestic. Biochem. Physiol.* 6(4): 363-366; 1976. (21 references)

Whether or not 3-trifluoromethyl- 4-nitrophenol (TFM) is an uncoupler of oxidative phosphorylation, and if so, how its potency relates to that of the classical uncoupler 2,4-dinitrophenol was investigated. Samples of liver mitochondria from adult Wistar rats were exposed to TFM or DNP. The uncoupling concentrations which caused a 50% reduction in the ADP/O ratios for rat liver mitochondria were 4.29 nM/mg mitochondrial protein for TFM and 11.15 nM for DNP. The increased oxygen consumption of the mitochondrial preparation was characteristic of uncoupling effects. This need not be attributed to the action of detoxication enzyme systems. Interference or synergism due to impurities of the commercial preparation of TFM may affect its differential toxicity characteristics in the field.

77-0164. Kashi, K. P.; Chefurka, W. (Dept. Zool., Univ. Western Ontario, London, Ontario, Canada). **The effect of phosphine on the absorption and circular dichroic spectra of cytochrome c and cytochrome oxidase.** *Pestic. Biochem. Physiol.* 6(4): 350-362; 1976. (37 references)

The effects of phosphine on cytochrome oxidase and cytochrome c as deduced by absorption and circular dichroic spectrometry are reported. Cytochrome oxidase treated with phosphine caused absorption spectra in both the visible and Soret regions which were similar to those produced by dithionite. Circular dichroic spectra also showed striking changes suggesting a valence change of the heme iron had been accompanied by a conformation change of the prosthetic group. Spectra similar to those produced by reduction with dithionite were obtained by phosphine treatment of cytochrome c suggesting a valence change of the heme iron. However, evidence indicated that the cytochrome c was relatively insensitive. Cytochrome oxidase reduction by phosphine had only a very minor effect on the intrinsic dichroic spectrum, suggesting little effect on the polypeptide chains. Phosphine apparently reduced only one component of the cytochrome $\alpha\,\alpha_3$ complex. The failure of EDTA and fluoride to affect the reduction of cytochrome $\alpha\,\alpha_3$ by phosphine, as well as the occurrence of a 436-nm isobestic point of the ferric-ferrous absorption spectra suggests that phosphine reduced mainly cytochrome α. However, a slow reduction of cytochrome α_3 cannot be ruled out.

77-0165. Nishioka, T.; Kitamura, K.; Fujita, T.; Nakajima, M. (Dep. Agric. Chem., Kyoto Univ., Kyoto, Japan). **Kinetic constants for the inhibition of acetylcholinesterase by phenyl carbamates.** *Pestic. Biochem. Physiol.* 6(4): 320-337; 1976. (19 references)

The most reliable kinetic constants for the inhibition of acetylcholinesterase by phenyl carbamates were obtained with a range of rather low inhibitor concentrations insofar as it satisfies the experimental conditions required for inhibition kinetics. A variety of experimental procedures were used to determine the kinetic constants of various substituted phenyl *N*-methyl- and *N,N*-dimethylcarbamates. A procedure was developed in the presence of a chromogenic substrate which was compared to the conventional Main method. The dissociation equilibrium constant, *Kd*, and the carbamylation rate constant, k_2, were shown to depend on the inhibitor concentration range used for the determination in both procedures. If the binding of further inhibitor molecules to the reverse complex and the carbamylated enzyme is significant under conditions with high inhibitor concentrations, the concentration dependence of the kinetic constants is nicely delineated. It is suggested that the low inhibitor concentration range whose product by ki is of the order of 0.2 - 1.0 min^{-1} allows the determination of reliable constants.

77-0166. Saad, W. A.; Camargo, L. A. A.; Cabral, A. M.; Morita, N.; Yashuda, Y. (Dept. Physiol. Sci., Sch. Pharm. Odontol., Araraquara, S. P. Brasil). **Effect of intrahypothalamic injection of methylic parathion and metasystox on food and water intake of normal and fasted rats.** *Pharmacol. Res. Commun.* 8(5): 485-493; 1976. (19 references)

The effects of anticholinesterase drugs on water and food intake were studied using Holtzman male rats. Methyl parathion and metasystox were injected directly into the lateral hypothalamic area (LHA) and the ventral

medial nucleus (VMN) through permanently implanted cannulae. When injected into the VMN, these drugs caused an inhibition of water intake. Injection into the LHA stimulated water intake. As to food intake, VMN stimulation produced an excitatory effect on appetite behavior. When comparing results obtained with metasystox and with methyl parathion, the effects produced by metasystox were generally more marked, while the behavior of methyl parathion was similar to that already reported with parathion. It is concluded that the action of endogenous brain acetylcholine released by the application of anticholinesterase drugs to the LHA produced a stimulation of water intake and an inhibition of food intake. When the VMN was involved, opposite effects were noted.

77-0167. Hattori, J.; Oizumi, K.; Sato, Y.; Tsuda, K.; Abe, T.; Harada, M. (Author address not given). **Biological properties of Sumithion.** *Residue Rev.* 60: 39-82; 1976. (51 references)

The public health and veterinary uses of Sumithion (fenitrothion) are discussed, as are its phytotoxicity and effects on beneficial insects. Sumithion is used extensively in pest-control operations, homes and gardens, and in vector control, especially mosquito control. There has been no development of cross resistance to Sumithion in *Culex* and *Anopheles* mosquitoes resistant to other insecticides and selection of *Culex* mosquitoes with Sumithion pressure did not result in a substantial lowering of susceptibility after 30 generations. Because of its low mammalian toxicity, Sumithion is useful for the control of flies, lice, fleas, mites, and ticks on domestic animals and poultry with direct and residual sprays. Sumithion is relatively toxic to honey bees although its practical use in the field does not adversely affect pollinating insect populations because of its short persistence. The pesticide has no apparent harmful effects on predatory insects. Sumithion shows some phytotoxicity when applied to crucifer vegetables and certain varieties of apples.

77-0168. Matsushita, T.; Arimatsu, T.; Tomio, T. (Sch. Pub. Health, Fac. Med., Kumamoto Univ., Kumamoto, Japan). [**Experimental studies on the occurrence of sensitized dermatitis due to dithiocarbamate pesticides.**] *Sangyo Igaku (Jpn. J. Ind. Health)* 18(3): 221; 1976. (Japanese)

The occurrence of contact dermatitis was studied after exposure to some fungicides, namely metallic salts of ethylenebisdithiocarbamic acid and their derivatives, using female Hartley guinea pigs. After determining the irritation threshold concentration of each compound on the animal's skin, the degree of sensitization and the degree of cross sensitization of the compounds were examined by Klingman's method. The results were positive for both metal salts of ethylene bis-dithiocarbamic acid and heavy metal salts of dimethyl dithiocarbamic acid. Lime-sulfur mixture produced relatively strong sensitized dermatitis. However, the degree of sensitization by ethylenethiourea and sodium dimethyl dithiocarbamate was slighter. Conspicuous cross sensitization was recognized between metal salts of ethylene bisdithiocarbamates themselves and metal salts of ethylene bisdithiocarbamic acid and heavy metal salts of dimethyl dithiocarbamic acid, especially in the case of the former.

77-0169. Sugimoto, T. (Biol. Res. Lab., Nihon Noyaku Co., Ltd. Oiso, Kanagawa, Japan). [**The occurrence of ocular lesions due to paraquat dichloride and their alleviation.**] *Sangyo Igaku (Jpn. J. Ind. Health)* 18(3): 222-223; 1976. (Japanese)

The herbicidal formulation Gramoxone (paraquat) causes severe ocular lesions when introduced into the eyes. On the other hand an aqueous solution of its active ingredient, paraquat dichloride, shows weak irritation to rabbit's eyes and does not damage the cornea. The factors relating to these phenomena and the method of improving the formulation were studied using guinea pigs. When 400 μg of paraquat dichloride was placed in the rabbit eye as an aqueous solution, no lesion occurred except for a slight palpebritis. However, when only 25-100 μg of paraquat dichloride was put into the eye as an aqueous solution with the surfactant which is used in Gramoxone, severe lesions accompanied by palpebritis, conjunctival injection, and corneal opacity were produced. Although the surfactant itself is not irritating its presence together with paraquat dichloride causes severe lesions. The effect of calcium acetate is probably due to the action of calcium ion on the ocular mucosa, or to the effect of selectively reducing the permeability of the mucosa to the active ingredient.

77-0170. Miyata, T.; Honda, H.; Saito, T.; Ozaki, K.; Sasaki, Y. (Lab. Appl. Entomol. Nematol., Fac. Agric., Nagoya Univ., Chikusa, Nagoya, Japan). **In vitro degradation of ^{14}C-methyl malathion by organophosphate susceptible and resistant smaller brown planthopper, *Laodelphax striatellus* (Fallen).** *Bochu-Kagaku (Sci. Pest Contr.)* 41(1): 10-15; 1976. (25 references)

The *in vitro* metabolism of ^{14}C-methyl malathion and the relation between β-naphthyl acetate hydrolyzing activity and ^{14}C-methyl malathion degrading activity of the E_7 band were studied. LC_{50} values of ^{14}C-methyl malathion susceptible (LE), malathion resistant (Rm), and fenitrothion resistant (Rf) strains of the planthopper to malathion were 159, 2, 190, and 637 ppm, resp. ^{14}C-Methyl malathion was degraded more than 7 and more than 5 times by the homogenate of Rm and Rf strains than by the homogenate of LE strain. Carboxylesterase products formed most of the metabolites of each strain. Small amounts of phosphatase products were detected. In vitro degradation of ^{14}C-methyl malathion was inhibited by almost 100% by K-2 (10^{-6}M) and dichlorvos (10^{-5}M). Enzymes of the smaller brown plant hopper were separated by agar-gel electrophoresis, and esterase pattern and de-

gradation of ^{14}C-methyl malathion were studied. Only one peak of malathion degradation was detected at the E_7 band.

77-0171. Epstein, S. S. (Med. Sch., Case Western Reserve Univ., Cleveland, OH 44106). **Carcinogenicity of heptachlor and chlordane.** *Sci. Total Environ.* 6(2): 103-154; 1976. (70 references)

Heptachlor, its epoxide, and chlordane were tested for carcinogenicity in both mice and rats in the eleven studies reviewed in this paper. The data from these studies, both individually and combined, indicate that heptachlor, its epoxide, and chlordane, both technical and pure, are carcinogenic in mice. For rats the carcinogenicity data are less extensive, but the suggestion of carcinogenicity is clear. Data on the carcinogenicity of technical chlordane in rats is not available. As heptachlor is a component of technical chlordane, all data relating to the carcinogenicity of heptachlor and its epoxide are relevant to determinations of the carcinogenicity of technical chlordane.

77-0172. Gowda, T. K.; Siddaramappa, R.; Sethunathan, N. (Lab. Soil Microbiol., Central Rice Res. Inst., Cuttack 753006, Orissa, India). **Heterotrophic nitrification and nitrite tolerance by *Aspergillus carneus* (van Tiegh) Blochwitz, a predominant fungus isolated from benomyl-amended soil.** *Soil Biol. Biochem.* 8(5): 435-437; 1976. (12 references)

In an effort to determine the role of *Aspergillus carneus* in causing NO_2 accumulation in benomyl-amended soil, the ability of this fungus to form NO_2 from both ammonia and NO_3 was studied. NO_2- (41.3 μg) was formed in the medium supplemented with benomyl at 5 days whereas in the absence of the fungicide, NO_2- (65.3 μg) was detected at 8 days. In both cases the NO_2- formed disappeared from the medium within the next 2 or 3 days. The fungus produced NO_2- also in media containing NH_4+ alone. Up to 8 days after inoculation, no NO_2- was detected; at 10 days, about 378 μg and 289 μg NO_2-/25 ml medium were formed from NH_2+ in benomyl-amended and unamended media. The fungus also produced NO_2- from peptone in the soils. The fungus grew well at 10^3 parts/10^6 $NaNO_2$. When total N in the mycelium and culture filtrate was measured after incubation of the fungus with 5 x 10^2 parts/10^6 $NaNO_2$ for 24 days, 17% of the added N was unaccounted for, perhaps due to the conversion of NO_2 to volatile products. These data provide evidence for heterotrophic nitrification of NH_4+-NO_2- by this benomyl-tolerant fungus in both *in vitro* and soil incubation studies. Oxidation to the end product NO_3- was not evident.

77-0173. Ackermann, H. (Forschungszentr. Molekularbiol. Med., Zentralinst. Ernaehr. Potsdam-Rehbrucke, DDR). **Uebergang phosphororganischer Insektizide in den Embryo—Bildung der PO-Derivate und Ausloesung toxischer Symptome.** [**Transfer of organophosphorus insecticides to the embryo—formation of PO-derivatives and development of toxic symptoms.**] *Tagungsber. Akad. Landwirtschaftswiss. DDR* 126: 23-29; 1974. (12 references) (German)

The effects of organophosphorus insecticides on pregnant albino rats were determined. Methylparathion, bromophos, and imidan (phosmet) ip were detectable from the placenta, liver, brain, muscle tissue, and fetuses of the rats. The PO isologue of methylparathion was detected in all embryonal tissue. When testing for bromophos and imidan, only traces of bromoxon, the PO isologue of bromophos, were recorded from fetal muscular tissue, while the imidan isologue was not detectable. Toxic symptoms were triggered during acute intoxication, which is in direct relation with PO isologue formation. During acute intoxication no direct relation existed between the applied dose of thionophosphoric acid compound and the inhibition of serum cholinesterase. Relations were established between the severity of intoxication and the occurrence of methyl-paraoxon as well as the inhibition of cholinesterase in muscle tissue, and in particular, muscle of the abdominal region.

77-0174. Knapek, R. (Inst. Organ. Indust., Pszczyna, Poland). **Methodik zur Untersuchung der Abbaugeschwindigkeit von Pestiziden in Pflanzen.** [**Methods to study decomposition rates of pesticides in plants.**] *Tagungsber. Akad. Landwirtschaftswiss. DDR* 126: 57-63; 1974. (German)

A method has been developed to study the decomposition rates of pesticides in plants. The procedure covers field experiments, sampling, preparation of crop samples, residue analysis, and interpretation of results. The method is a complex approach to localization of the site of the experiment, plot size, number of trees or shrubs involved, application with the number of repetitions and timing, applied concentrations, spraying volume, and type of application equipment. Frequency and method of sampling, minimum weights of field samples, and reduction of samples for laboratory testing are all specified. The method of analysis is also fixed. The results are presented as decomposition curves in semi-logarithmic coordinate systems. The extent to which weather conditions during tests must be recorded is discussed.

77-0175. Knapek, R.; Lakota, S. (Inst. Organ. Ind., Pszczyna, Poland). **Einige Biotests zur Untersuchung der toxische Wirkung von Pestiziden in Wasser.** [**Biological testing to determine toxic effects of pesticides in water.**] *Tagungsber. Akad. Landwirtschaftswiss. DDR* 126: 105-109; 1974. (German)

The detrimental effects of pesticides were studied in water enviro:.ments in Poland. Tests took into consideration the pesticide concentration employed and the effect on water organisms. *Chlorella, Daphnia magna* and gup-

pies were studied, along with fish of various species of natural origin. The methods used were applied to a number of preparations to determine LD50, threshold, and highest non-toxic concentrations. The effect of other factors on pesticide activity was also studied, including temperature and available oxygen.

77-0176. Lakota, S. (Inst. Organ. Ind., Pszczyna, Poland). **Die toxische Wirkung von Methoxychlor auf einige Wassertiere.** [**Toxic action of methoxychlor on certain water animals.**] *Tagungsber. Akad. Landwirtschaftswiss. DDR* 126: 111-115; 1974. (German)

The degree of toxicity of methoxychlor to certain animals in water habitats was tested as part of a study into toxic side effects of this compound. The active ingredient was applied to carp (*Cyprinus carpio* L.), tench (*Tinca tinca* L.), trout (*Salmo trutta morpha fario* L.), guppy (*Lebistes reticulatus* L.), daphnia (*Daphnia magna* L.), *Asellus aquaticus*, *Lumbriculus*, and mosquito larvae (*Aedes aegypti* L.). The LD50, threshold concentration, and maximum non-toxic concentrations were determd. The toxicity of methoxychlorine differed clearly according to the species tested, with the LD50 values ranging from 0.001 mg/l to 0.933 mg/l.

77-0177. Khaikyna, B. J.; Kuz'mynska, U. A.; Veremenko, L. M. (All-Union Res. Inst. Hyg. Toxicol. Pesticides, Polymers Plastic Materials, Min. Pub. Health, Kiev, USSR). **Nabryakannya i skorochennya mitokhondriy pechniki schuriv dii na tvarin γ-izomeru geksakhlortsiklogeksanu i polikhlorkamfenu.** [**Swelling and contraction of rat liver mitochondria under effect of hexachlorocyclohexane γ-isomer and polychlorocamphene on animals.**] *Ukr. Biokhim. Zh.* 47(4): 487-490; 1975. (6 references) (Ukrainian)

The swelling and contraction of rat liver mitochondria caused by the organochlorine pesticides γ-HCCH (lindane) and polychlorocamphene (PCC) were studied. After 2 days of giving γ-HCCH at a dose of 34 mg/kg and PCC at a dose of 48 mg/kg, swelling was noted of the liver mitochondria in in vivo tests. Also noted was a decrease in their ability to swell in KCl and KH_2PO_4 and to contract with the addition of ATP. After a 6 month period of dosing with 1.7 mg/kg γ-HCCH, the parameters under study rose and, in the case of PCC, analogous administration in a dose of 2.4 mg/kg caused these same parameters to drop. The differences in the effects of these two pesticides may be caused by singularities in their cumulative properties.

77-0178. Adamec, O.; Kosutzky, J.; Ledec, M. (Nat. Inst. Anim. Hosp., 900 28 Ivanka pri Dunaji, Czechoslovakia). **Vplyv lindanu na biologicku ucinnost estradiolu u kurciat.** [**The effect of lindane on the biological effectiveness of estradiol in chickens.**] *Vet. Met. (Praha)* 20(5): 309-314; 1975. (13 references) (Czech)

Sexually immature chickens were exposed to lindane in doses of 2.5 to 25.0 mg/kg in their food. The effect of this exposure on the biological activity of estradiol was determined. The application of lindane for 14 days caused a statistically significant depression of the biological effectiveness of estrogens. In comparison with controls, the stimulated mass of the oviduct of animals exposed to lindane was smaller by 12.7 to 17.1% and the average concentration of serum calcium decreased by 8.0 to 27.6%. These results indicate that the influence of lindane in relatively low concentrations is significant on the effectiveness of exogenous estrogens.

77-0179. Krustev, E. (Vet. Sci. Res. Inst., Veliko, Turnovo, Bulgaria). **Izsledvaniya vurkhu aktivnostta na eritrotsitnata kholinesteraza pri zdriva i otrovenii s diptereks ovtse i goveda.** [**Studies on the activity of the erythrocyte cholinesterase in sheep and cattle intoxicated with dipterex and in normal ones.**] *Vet. Med. Nauki* 12(1): 1-15; 1975. (17 references) (Bulgarian)

The erythrocyte cholinesterase levels were determined in 272 sheep and 120 cattle under normal conditions. The average value of the enzyme activity in sheep was 82±2.44 units, and in cattle the corresponding value was 146±6.13 units. In 55 sheep given dipterex (trichlorfon) p.o. at 150, 200 and 250 mg/kg, measurements revealed that the activity of the enzyme was below the lower normal value limit. The marked inhibition of the erythrocyte cholinesterase was accompanied by the clinical manifestations of organic phosphorus intoxication. In other animals the inhibition was not so marked and clinical signs were absent. It is suggested that the enzyme activity inhibition is a preclinical symptom of organic phosphorus poisoning. However, the degree of inhibition was not indicative of the severity of the disease in all cases. As the clinical manifestations and the degree of enzyme inhibition do not correlate with the degree of illness, all animals suspected of suffering from organophosphorus intoxication are to be studied in terms of the inhibition of their erythrocyte cholinesterase activity.

77-0180. Serns, S. L. (Water Resour. Res., Wisconsin Dep. Nat. Resour., Madison, WI 53711). **The effects of dipotassium endothall on the zooplankton and water quality of a small pond.** *Water Resour. Bull.* 11(6): 1221-1231; 1975. (19 references)

Acute and chronic effects of dipotassium endothall on zooplankton densities and composition under field conditions were studied. Various parameters were studied before and after the application of 5.0 mg/l dipotassium endothall to the 0.31 ha treatment pond. No differences were noted in the seasonal fluctuations of densities of *Cladocera* and *Copepoda* in treated and control ponds. No apparent changes in species composition or generic densities of Cladocerans were noted between the treatment pond and the control pond. Dipotassium endothall had no effect on either the Calanoida or Cyclopoida suborders of Copepoda. A later pulse of Ostracoda in the treated pond,

when compared to the control, may have been due to the dipotassium endothall or to a combination of the effects of the herbicide on the macrophytes and the method of sampling. From 3 to 21 days after treatment a decrease in dissolved oxygen was noted in the treated pond. This was attributed to an increase in biological oxygen demand associated with weed-kill. No noticeable increase in plant nutrients was found in the treated pond. No apparent changes in other chemical parameters were noted either.

77-0181. Pfeilsticker, K.; Siddiqui, I. R. (Lehrst. Lebensmittelwissensch. Univ. Bonn., Germany). **Trennung der durch Aethylenoxyd (A)-1,2-^{14}C-derivatisierten Inhaltsstoffe von Kakao und Verteilung der Radioaktivitaet auf Stoffgruppen. [Group separation of ethylene oxide 1,2-^{14}C fumigated cocoa-powder derivatives and their distribution of radioactivity.]** *Z. Lebensm. Unters.-Forsch.* 158(3): 157-161; 1975. (9 references)

A procedure is described for the separation of ethylene oxide-1,2-^{14}C fumigated cocoa-powder derivatives into nine different groups. The method is based on extraction, column chromatography and precipitation. In wheat the major portion of radioactivity falls in the water extract; in cocoa powder the major portion of the radioactivity was found in the low molecular weight components.

77-0182. Bend, J. R.; Pohl, R. J.; Arine, E.; Philpot, R. M. (Pharmacol. Br., Natl. Inst. Environ. Health Sci., Research Triangle Park, NC 27709). **Hepatic microsomal and solubilized mixed-function oxidase systems from the Little Skate, *Raja erinacea*, a marine elasmobranch.** *Hoppe-Seylers Z. Physiol. Chem.* 357(8): 1021-1022; 1976. (1 reference)

Microsomes from skate liver have relatively high mixed-function oxidase activity when compared to other marine species. Pretreatment of little skates with 3-methyl-cholanthrene, 1,2,3,4-dibenzanthracene or 2,3,7,8-tetrachlorodibenzo- *P*-dioxin (TCDD) caused significant increases in microsomal benzo(a)pyrene hydroxylase activity (up to 10-fold) without any concomitant increase in cytochrome P-450 or formation of cytochrome P-448. Phenobarbital did not affect either microsomal cytochrome concentrations or microsomal protein yields. Pretreatment of skates with TCDD did not affect hepatic epoxide hydrase or glutathione S-transferase activities as determined by using (β-^{14}C)styrene oxide as the substrate. Hepatic microsomal mixed-function oxidase system was solubilized and separated into its component parts for further study. Skate hepatic cytochrome P-450 was purified 12-fold from microsomes to a specific content of 30 nmol/mg protein. Purification was achieved by chromatography of sodium cholate-solubilized microsomes on DEAE-cellulose followed by chromatography on hydroxylapatite. NADPH-cytochrome c reductase was purified by chromatography of sodium deoxycholate-solubilized microsomes on DEAE-cellulose.

77-0183. Hoagland, R. E. (Dep. Biochem., North Dakota State Univ., Fargo, ND 58102). **Hydrolysis of 3′,4′-dichloropropionanilide by an aryl acylamidase from *Taraxacum officinale*.** *Phytochemistry* 14(2): 383-386; 1975. (23 references)

An acyl acylamidase (aryl-acylamine admidohydrolase, E. C. 3.5.1.a), which hydrolyzed propanil was isolated from dandelion roots. It seemed to assume an intermediate position between the particulate enzyme as found in rat liver and the tulip enzyme that is completely soluble. The enzyme was isolated by extraction of dandelion root tissue with buffer and purified by ammonium sulfate precipitation and Sephadex gel filtration. Eight-fold purification was achieved with 89% recovery. A related enzyme is also present in dandelion leaves. The enzyme had a very broad pH optimum. It was 50% inactivated on heating for 5 min at 46-48°, and its optimum temperature for assay with propanil as substrate was 35°. The enzyme had a broad substrate specificity on mono- and dichlorosubstituted propionanilides, with a high preference for propanil. It did not hydrolyze amide bonds of fenuron, monuron, propham, or chlorpropham. It was appreciably inhibited by copper and mercury ions, catechol, *p*-chloromercuribenzoic acid, and *p*-benzoquinone, but inhibition by sulfhydryl reagents was only 2-27%.

77-0184. Poland, A.; Glover, E.; Kende, A. S.; DeCamp, M.; Giandomenico, C. M. (Dep. Pharmacol. Toxicol., Univ. Rochester Sch. Med., Rochester, NY 14642). **3,4,3′,4′-Tetrachloro azoxybenzene and azobenzene: potent inducers of aryl hydrocarbon hydroxylase.** *Science* 194(4265): 627-630; 1976. (18 references)

Two unwanted contaminants, 3,4,3′,4′-tetrachloroazoxybenzene (TCAOB) and 3,4,3′,4′-tetrachloroazobenzene (TCAB), formed in the commercial synthesis of 3,4-dichloroaniline or of herbicides made from 3,4-dichloraniline, were responsible for three outbreaks of acute chloracne among chemical workers. TCAOB and TCAB are approximately isosteric to 2,3,7,8-tetrachlorodibenzo- *p*-dioxin and 2,3,7,8-tetrachloro- dibenzofuran, two well-known contaminants that cause acne. All four of these agents are potent inducers of hepatic aryl hydrocarbon hydroxylase activity and compete for sterospecific binding sites in the hepatic cytosol, which are thought to be the receptor sites for the induction of this enzyme. Among the chlorinated azoxy and azobenzenes, the potency of a congener to induce aryl hydrocarbon hydroxylase activity correlates with its binding affinity for the hepatic cytosol specific binding sites and its capacity to induce acne; this relation between structure and activity parallels that observed for the chlorinated dibenzo-*p*-dioxins and dibenzofurans. (Author abstract by permission. Copyright 1976 by the American Association for the Advancement of Science)

77-0185. Iatropoulos, M. J.; Hobson, W.; Knauf, V.; Adams, H. P. (Internat. Ctr. Environ. Safety, Albany

Med. Coll., Holloman AFB, NM 88330). **Morphological effects of hexachlorobenzene toxicity in female rhesus monkeys.** *Toxicol. Appl. Pharmacol.* 37(3): 433-444; 1976. (25 references)

Hexachlorobenzene was administered daily by gavage to five adult female rhesus monkeys for 60 days. Two received 128 mg/kg of HCB, one 64 mg/kg, one 32 mg/kg, and one 8 mg/kg. Complete histopathological examination revealed thymic cortical atrophy; degenerative ovarian changes involving the primary follicles, germinal epithelium, and stroma; degenerative changes in the liver which included alterations compatible with porphyria tarda; and degenerative changes in the kidney. No cutaneous or neurological alterations were observed. The mechanism(s) by which HCB and/or its metabolites induce these morphologic effects was not established. (Author abstract by permission)

77-0186. Blase, B. W.; Loomis, T. A. (Univ. Washington, Dep. Pharmacol., Seattle, WA 98195). **The uptake and metabolism of carbaryl by isolated perfused rabbit lung.** *Toxicol. Appl. Pharmacol.* 37(3): 481-490; 1976. (16 references)

The isolated perfused rabbit lung was used to study the uptake and metabolism of carbaryl. Analysis of the uptake data revealed that movement of carbaryl from the perfusate into the lungs was by simple diffusion. In 15 min, 26% of the dose of carbaryl was taken up. Ouabain (10^{-4} M) had no statistically significant effect on uptake or metabolism. It was found that changing the perfusion flow rate significantly influenced the uptake of carbaryl. Analysis of the dichloromethane extracts of perfusate and lung tissue using high pressure liquid chromatography revealed the presence of the carbaryl metabolites, 4-hydroxycarbaryl and α-naphthol. A number of unidentified peaks was also seen. It was concluded that the lungs are able to take up and metabolize significant quantities of carbaryl. (Author abstract by permission)

77-0187. Hyde, K. M.; Falkenburg, R. L. (Biol. Dep., Point Loma Coll., San Diego, CA 92106). **Neuroelectrical disturbance as indicator of chronic chlordane toxicity.** *Toxicol. Appl. Pharmacol.* 37(3): 499-515; 1976. (29 references)

Adult male rats equipped with chronically implanted electrodes were treated with chlordane ip to examine its influence on spontaneous electrocortical activity. Injections of 350 mg/kg resulted in characteristic signs of organochlorine poisoning, culminating in death within 1 hr. Neurotoxic effects of lethal exposure were seen as high-amplitude episodes (400-630 μV) with secondary respiratory waves leading to isoelectric tracings; respiratory depression was therefore implicated in chlordane-induced mortality. EEGs monitored from unanesthetized rats subjected to daily, low-level injections (0.15, 1.75, and 25.0 mg/kg) revealed dose-dependent alterations of brain potentials without behavioral signs of chronic toxicity. Mean spontaneous activity from all montages was significantly increased after 42 days (47-80% above predosage and control values.) Changes included a progressive shift toward fast beta rhythms (> 25 Hz), reduction of delta (0.5-3 Hz) and theta (4-7 Hz) frequencies, elevation of amplitude, and replacement of sinusoidal waves by sharp, complex discharges. These changes were directly related to length of exposure, thus implying that chlordane is a cumulative neurotoxin. Starvation and concurrent chlordane treatment interacted synergistically to produce abnormal high-voltage potentials suggestive of lethal cerebral patterns. We interpreted appearance of these slow-wave spikes as evidence of chlordane mobilization from storage depots and subsequent neuroconcentration. Removal of chlordane failed to stimulate recovery of the EEG. Instead, significant deviations from controls continued after 60 days withdrawal. It may be concluded, therefore, that chlordane is a persistent neurotoxin and that electrocerebral disturbance is an early and sensitive indicator of chlordane intoxication. (Author abstract by permission)

See also **77-0053** **77-0054**

77-0188. Kredl, F.; Breyl, I. (Stat. Vet. Ust. Lov. Zver, Jihlava, Czechoslovakia). **Samovolny rozklad cisteho endrinu.** [**Spontaneous decomposition of pure endrin.**] *Agrochemia (Bratislava)* 15(6): 177-179; 1975. (5 references) (Czech)

Thin-layer chromatographic, gas chromatographic, and IR spectrum analyses were conducted on endrin recrystallized from a commercial compound, very pure standard endrin, and a sample of isomeric ketone. Results indicated that, over the course of time, pure samples of endrin are subject to transformation into endrin-ketone. Thus the determination of endrin residues using a very pure sample of endrin which is several years old as a standard can lead to significant errors. It is therefore better to use a freshly prepared sample obtained from standard endrin of commercial-grade purity via recrystallization.

77-0189. Narine, D. R.; Peach, M. E.; Stiles, D. A. (Dep. Chem., Acadia Univ., Wolfville, NS, Canada BOP 1XO). **The determination of organochlorine pesticides in sediment by molecular emission cavity analysis.** *Anal. Lett.* 9(8): 767-774; 1976. (6 references)

A rapid and convenient method is described for measuring the total organic chlorine content of sedimentary material fortified with organochlorine pesticides. The pesticides are extracted from the sediment, chlorine is then liberated as hydrogen chloride in a Schoniger flask, and the resulting aqueous solution is injected into an indium-lined MECA (Molecular Emission Cavity Analyser) cavity. The MECA response to the InCl emission is used to determine the amount of halogen present. The study has included sediment samples spiked with between 5 and 25 ppm of *p,p'*-DDT, γ-BHC, and heptachlor, when the percentage recovery in each case is estimated to be greater than 95% with a similar value recorded for a mixture of all three insecticides. (Author abstract by permission)

77-0190. Moye, H. A.; Wade, T. E. (Pestic. Res. Lab., Food Sci. Dep., Univ. Florida, Gainesville, FL 32611). **A flurometric enzyme inhibition detector for carbamate pesticide analysis by high speed liquid chromatography.** *Anal. Lett.* 9(10): 891-920; 1976. (18 references)

Because of the thermal instability of the *N*-methyl carbamates, high-speed liquid chromatography was examined as an analytical method using fluorometric detection of cholinesterase inhibition. *N*-methylindoxyl acetate was selected as the fluorophore producing substrate, and housefly head cholinesterase was used because of its high sensitivity for carbaryl, along with horse plasma, bovine erythrocyte, and human plasma cholinesterase. Various experimental arrangements, gas bubble patterns, detector sensitivities, and reaction conditions were examined. It was concluded that less retention but more efficient columns than the BODS permaphase column employed would have been desirable. However, high sensitivity and selectivity were achieved with a dynamically operated enzyme inhibition detector operating in tandem with a high speed liquid chromatographic column.

77-0191. Onuska, F. I.; Comba, M. E.; Harrison, A. G. (Environ. Canada, Canada Cent. Inland Waters, Anal. Methods Res. Sect., Burlington, Ontario, L7R 4A6, Canada). **Chemical ionization and high resolution electron impact mass spectra of 5,6-dihydro- 2-methyl- 1,4-oxathiin-3-carboxanilide and three of its metabolites.** *Biomed. Mass Spectrometry* 3(5): 248-254; 1976. (15 references)

A determination was made of the electron impact and the hydrogen and methane chemical ionization mass spectra of 5,6-dihydro- 2-methyl- 1,4-oxathiin-3-carboxanilide, the sulfoxide and sulfone derived thereform, and 2-(2-hydroxyethylthio) acetoacetanilide enol. All four compounds showed abundant molecular ions in the electron impact spectra and abundant (MN)+ ions in the methane chemical ionization spectra, but relatively low (MH)+ ion signals in the hydrogen chemical ionization spectra. Electron impact fragmentation mechanisms were established from high resolution mass measurements and metastable transitions determined by metastable ion refocusing. For 5,6-dihydro- 2-methyl- 1,4-oxathiin-3-carboxanilide, 5,6-dihydro- 2-methyl- 1,4-oxathiin-3-carboxanilide- 4-oxide, and 5,6-dihydro- 2-methyl- 1,4-oxathiin- 3-carboxanilide- 4,4-dioxide the major fragmentation mode involved loss of the anilino radical from (M)+ with subsequent loss of C_2H_4. The electron impact mass spectrum of 2-(2-hydroxyethylthio) acetoacetanilde was dominated by the molecular ion and the aniline molecular ion. However, in the chemical ionization mass spectra characteristic fragment ions involving loss of water and loss of aniline from (MH)+, as well as protonated aniline, are observed and serve to characterize the compound.

77-0192. Ikeda, S.; Satake, H. (Sch. Appl. Chem., Fac. Technol., Tokushima Univ., Tokushima, Japan). [**Rapid determination of dithiocarbamates by amperometric titration.**] *Bunseki Kagaku (Jpn. Anal.)* 25(9): 611-615; 1976. (14 references) (Japanese)

Using a rotating platinum wire electrode at a potential of + 0.7 V as the indicating electrode and a mercury-mercuric iodide counter electrode, the rapid determination of dithiocarbamates was studied. The carbamates used were sodium dimethyldithiocarbamate, dimethylammonium dimethyldithiocarbamate, sodium diethyldithiocarbamate, ammonium pyrrolidinedithiocarbamate, and diethylammonium diethyldithiocarbamate. In the amperometry of these compounds it was found that a base solution consisting of 0.1 *M* of ammonia, 0.1 *M* of ammonium acetate, and 0.1% of Triton-100 was appropriate for titrating with a standard solution of silver nitrate at 15-20°C, high accuracy was obtained and the time of titration was less than 10 min.

77-0193. Gebefugi, I.; Parlar, H.; Korte, F. (Inst. Oekol. Chem., Gesellsch. Strahlen- Umweltforsch, MBH,

Munich, Germany). **Beitraege zur oekologischen Chemie CXXVI. Kurze Mitteilung ueber die analytische Erfassung von Pentachlorphenol in geschlossenen Raeumen. [Contributions to ecological chemistry part 126. Note on the analytical detection of pentachlorophenol in closed chambers.]** *Chemosphere* 4: 227-230; 1976. (9 references) (German)

PCP released into an experimental room from treated paneling was collected by drawing air from the room through two gas washing bottles, each containing 100 ml of 0.1 M potassium carbonate. PCP was then esterified with acetic anhydride to yield phenol acetate, extracted with *n*-hexane, and determined quantitatively by gas chromatography (1 m glass column packed with 3% OV 101, 180° isothermal, nitrogen flow rate 40 m/min). After reaching an initial maximum level in the room, the measured PCP concentrations fluctuated greatly. High room temperatures were consistently related to high PCP vapor pressures, but could not be considered solely responsible for the measured concentration peaks, nor could variations in humidity. The PCP concentrations measured varied between 1 and 160 $\mu g/m^3$. Thus under unfavorable external conditions the PEP concentration in closed rooms might reach 200 $\mu g/m^3$ or more, and a need for further studies is indicated.

77-0194. Goeke, G. (Chem. Untersuchungsamt, Hagen, Germany). **Rationelle Pestizid-Rueckstandsanalysen von tierischen Lebensmitteln durch Sweep-Co-Destillation und GC—Datenverarbeitung. [Efficient pesticide residue analyses in foods of animal origin by sweep codistillation and GC data processing.]** *Deut. Lebensmittel-Rundschau* 71(9): 309-314; 1975. (15 references) (German)

The sweep codistillation process has become widely used for multiresidue pesticide detection. The crude food extracts are distributed onto heated glass beads, then the pesticides dissolved in a continuous rinsing and codistillation process using low-boiling solvents, and collected in a cold trap. They are washed from the receiver into a column packed with Florisil or Anacrom and determined on a gas chromatograph after concentration or dilution. The commonly used Kontes apparatus can be impoved by replacing glass-rubber connections by screw caps and injection diaphragms and Teflon tubing by silicone rubber, as well as by addition of modern electronic controls for the furnace temperature and improved cold traps. Pesticides are identified via the retention times relative to parathion or aldrin on an ECD gas chromatograph. The results could be obtained more rapidly and reliably by using an electronic data processing system for evaluation. The recovery rates from 1 g of animal fat for 16 of the 17 organochlorine pesticides investigated were better than 80%. Methoxychlor gave a recovery rate of 70%. Conversion of DDT to TDE on the column was negligible. A mixed phase GC column (polar plus nonpolar phases) gives adequate separation of pesticides with different retention times.

77-0195. Thielemann, H. (Halberstadt, DDR). **Duennschicht- chromatographische Auftrennung und Identifizierung eines Gemisches von polychlorierten Biphenylen (PCB) und *p,p'*-DDE an paraffinimpraegnierten Kieselgur G-Schichten. [Thin layer chromatographic separation and identification of a mixture of polychlorinated biphenyls (PCB) and *p,p'*-DDE on paraffin impregnated kieselgur G layers (diatomaceous earth).]** *Fresenius Z. Anal. Chem.* 282: 144; 1976. (German)

The TLC determination of *p,p'*-DDE residues in the presence of polychlorinated biphenyls (PCB) is complicated by the existence of a PCB spot with the same retention time as *p,p'*-DDE using a variety of solvents and stationary phases. Kieselgur layers were prepared by suspending the diatomaceous earth preparation in water, spreading onto glass plates, drying, washing out the chlorine with 60% acetone, and activating in a drying oven for 30 min at 110°C. The plates were then dipped in a shallow glass dish containing 8% liquid paraffin in petroleum ether, and air dried. The solvent mixture used was acetonitrile/acetone/methanol/water (40:18:40:2). After 2 hr of development the plates were sprayed with ammoniacal silver nitrate solution, then irradiated under UV for 30 min. Under these conditions Clophen A-50 gave spots with *Rf* values of 40, 44, 51, 57, and 66, while the *Rf* of *p,p'*-DDE was 63, and it was clearly separated from the PCB spots.

77-0196. Lunde, G.; Baumann Ofstad, E. (Cent. Inst. Indust. Res., Blindern, Oslo 3, Norway). **Determination of fat-soluble chlorinated compounds in fish.** *Fresenius Z. Anal. Chem.* 282: 395-399; 1976. (8 references)

The level of chlorinated non-polar compounds in samples of sprat (*Clupea sprattus*) has been determined. The total amounts of chlorine, bromine and iodine in the lipid phase were determined by neutron activation analysis prior to and after treatment of the lipid phase with concentrated sulfuric acid. In sprat samples from a contaminated area the following chlorinated hydrocarbons have been identified and quantified by means of gas chromatography and mass spectrometry: pentachlorobenzene, hexachlorobenzene, heptachlorostyrene and octachlorostyrene. In addition, the following compounds have been detected by gas chromatography using standards: dichlorobenzene, trichlorobenzene, tetrachlorobenzene and polychlorinated biphenyls. A gradual reduction of the level of individual components and total level of chemically persistent chlorinated hydrocarbons in the samples is observed with increasing distance from the source of contamination (Frierfjorden). The same tendency is not seen for PCB. It has been found that highly chlorinated compounds are distinctly enriched in the sprat oil relative to compounds with lower contents of chlorine. (Author abstract by permission)

77-0197. Hoogeveen, L. P. J.; Willmott, F. W.; Dolphin, R. J. (Philips Res. Lab., Eindhoven, The Netherlands). **An**

automatic monitor for the analysis of organochlorine compounds in milk. *Fresenius Z. Anal. Chem.* 282: 401-406; 1976. (13 references)

In the described monitor for organochlorine compounds the milk is deproteinized and extracted with hexane in a novel continuous extractor. After on-line filtering and drying, a sample of the extract is injected into a high performance liquid chromatograph consisting of a pre-column and an analytical column linked by switching valves. Both columns are packed with microparticulate silica gel. The pre-column provides sample clean-up, retention of fat, and the preliminary separation of the organochlorine compounds into two groups. A flow switching program holds the first group on the analytical column while the late eluting group, which already has adeuqate resolution, is directly led to an electron capture detector. The early eluting group is then detected after further separation on the analytical column. Fat is backflushed from the pre-column by a more polar solvent and measured by a refractive index detector. Finally the pre-column is regenerated. All the steps of sampling, pretreatment, cleanup, chromatographic separation and detection are performed automatically under the control of a microcomputer. (Author abstract by permission)

77-0198. Lakshminarayana, V. (Central Plant Protection Training Inst., Hyderabad-30, India). **Determination of zineb by oxidation with chloramine-T.** *J. Agric. Food Chem.* 24(5): 1035-1036; 1976. (4 references)

A simple volumetric procedure was established for determining the amount of zineb in its formulations. The organic impurities and sulfur are removed from the formulation by washing the sample successively with ethyl alcohol, chloroform, and dilute acetic acid. The residue is dissolved in dilute sodium hydroxide when the zineb goes into solution leaving behind the insoluble zinc sulfide. Zineb itself is then determined by taking an aliquot of the alkine solution and allowing oxidation to occur by chloramine-T. Experimentation revealed that each mol of zineb requires 30 equiv of chloramine-T. Therefore, 1 ml of 0.1 *N* chloramine-T is equivalent to 0.919 mg zineb. There is no special apparatus required for this analysis and the procedure is very simple and rapid. It is also accurate and is well suited therefore for routine analyses.

77-0199. Newsome, W. H. (Food Res. Div., Bureau Chem. Safety, Foods Directorate, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada). **A gas-liquid chromatographic method for the determination of dodine residues on food.** *J. Agric. Food Chem.* 24(5): 997-999; 1976. (3 references)

A gas-liquid chromatographic method was developed which would allow detection of low levels of dodine on fruit crops and permit confirmation by mass spectrometry. The method calls for extraction with methanol, partitioning with chloroform, and formation of the hexafluoroacetyl acetone derivative. Under specified conditions the derivatization of dodine was quantitative. The presence of 20% methanol or shortening the reaction time to 30 min reduced the yield to about 30%. The minimum detectable limit, defined as twice background, was 8 ppb. A linear relation was noted between the amount of dodine added to the sample and that found after extraction, derivatization, and cleanup between 0.05 and 10.0 ppm. Mean recoveries for the concentrations examined were 84% or greater. The sensitivity of confirmation by single ion monitoring on the mass spectrometer was similar to that of electron capture detection. Presumably, confirmation could be achieved at lower levels by concentrating the column eluate.

77-0200. Griffitt, K. R.; Craun, J. C. (Food Drug Admin., Kansas City, MO 64106). **Gel permeation chromatographic system: an evaluation.** *J. Assoc. Off. Anal. Chem.* 57(1): 168-172; 1974. (3 references)

A gel permeation chromatography (GPC) system, including an automated GPC instrument, was evaluated and was found to be a reliable and efficient tool for fat-pesticide separations. In most cases more than 98% of the fat or oil was eluted from the column before the pesticides fraction began to elute. Cleanup efficiency was better than that obtained with acetonitrile partitioning, even when a petroleum ether backwash was used. Recoveries of several pesticides and industrial chemicals from milk fat were determined, with GPC as the only cleanup technique employed before gas chromatographic determination. Recoveries generally were better than those obtained with acetonitrile partitioning followed by Florisil cleanup. The automated instrument can be in operation unattended during non-working hours and, after loading, will automatically clean up 23 individual fat samples. (Author abstract by permission)

77-0201. Huckins, J. N.; Stalling, D. L.; Johnson, J. L. (Fish-Pestic. Res. Lab., U.S. Fish Wildl. Serv., Columbia, MO 65201). **Silicic acid chromatographic separation of polychlorinated biphenyls and pesticides: some contaminants and limitations.** *J. Assoc. Off. Anal. Chem.* 59(5): 975-981; 1976. (14 references)

The Armour and Burke method for separating polychlorinated biphenyls (PCBs) from pesticides involves the use of silicic acid. However, we detected di-2-ethylhexyl phthalate, PCBs, and other impurities as interfering contaminants in several batches of silicic acid. The presence of H_2SO_4 in some batches of silicic acid is inferred. The acid may be responsible for the production of contaminants which interfere in gas-liquid chromatographic analyses. Contaminants in silicic acid are reduced by extracting the adsorbent with solvent, and/or partitioning the concentrated pesticide fraction with 1*N* NaOH. These purification procedures provide separations relatively free of impurities, but result in reduced adsorbent activity. PCB-pesticide separations are reproducible only within a given batch lot of silicic acid because of the

varying adsorbent characteristics of each lot. Alternative adsorbents should be explored for most PCB-pesticide separations. (Author abstract by permission)

77-0202. Dougherty, R. C.; Piotrowska, K. (Dep. Chem., Florida State Univ., Tallahassee, FL 32306). **Multiresidue screening by negative chemical ionization mass spectrometry of organic polychlorides.** *J. Assoc. Off. Anal. Chem.* 59(5): 1023-1027; 1976. (10 references)

A multiresidue procedure, based on negative chemical ionization (NCI) mass spectrometry, for analyzing organochlorine residues in environmental substrates is described. The procedure is capable of routinely detecting about 1 ng unknown organochlorine residues. Semiquantitative data (order of magnitude) may be obtained for pentachlorophenol and 2,4,5-trichlorophenoxyacetic acid residues by calibration with internal *p*-chlorobenzophenone. Lipid-rich substrates were resolved into acidic and neutral fractions, and both fractions were further purified by gel permeation chromatography (GPC) prior to NCI analysis. In spite of the fact that recoveries were often low, the overall sensitivity for residues in lipid-rich substrates appeared to be higher than when the GPC step was omitted. (Author abstract by permission)

77-0203. Lawrence, J. F. (Food Res. Div., Health Protect. Br., Health Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A OL2). **Evaluation and confirmation of an alkylation gas-liquid chromatographic method for the determination of carbamate and urea herbicides in foods.** *J. Assoc. Off. Anal. Chem.* 59(5): 1061-1065; 1976. (5 references)

An alkylation technique using methyl iodide and sodium hydride in dimethyl sulfoxide has been evaluated for 3 carbamate and 7 urea herbicides in 9 foods. Recoveries ranged from 56 to 113%, depending on herbicide, concentration, and food type. Reproducibility was about ± 6% at 0.1 and 1.0 ppm. Identities of the herbicides were confirmed at these and lower levels by cleaving the aniline moiety from the alkylated herbicides with sodium methoxide in methanol, followed by gas-liquid chromatography on the same column as the parent compound. An electrolytic conductivity detector in the nitrogen mode was used for all analyses. Minimum detectable levels were in the range of 0.005-0.01 ppm in the foods studied. (Author abstract by permission)

77-0204. Lawrence, J. F. (Food Res. Div., Health Protect. Br., Health Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A OL2). **High-pressure liquid chromatographic analysis of urea herbicides in foods.** *J. Assoc. Off. Anal. Chem.* 59(5): 1066-1070; 1976. (14 references)

A method is described for the direct analysis of the urea herbicides linuron, monuron, diuron, chlorbromouron, fluometuron, chloroxuron, and fenuron in cabbage, corn, potatoes, turnip, and wheat at 0.01-1.0 ppm. The samples are extracted with acetone; the filtrate is partitioned with hexane-methylene chloride (1+1) followed by 2 other extractions with methylene chloride. The organic phases are dried and concentrated for column chromatographic cleanup on 2% deactivated Florisil. The column fractions are evaporated just to dryness and redissolved in 10 ml isooctane for high-pressure liquid chromatography on a 25 cm silica gel (5 μm) column. Isopropanol in isooctane is the mobile phase, and compounds are measured by ultraviolet absorption at 254 nm. Recoveries are > 80% in most cases. These results are confirmed by alkylation with sodium hydride-methyl iodide in dimethyl sulfoxide to form the methyl products which are analyzed by the same chromatographic system or by gas-liquid chromatography. (Author abstract by permission)

77-0205. Nicholas, M. L.; Powell, D. L.; Williams, T. R.; Huff, S. R. (Dep. Chem., Coll. Wooster, Wooster, OH 44691). **Reference Raman spectra of ten phosphorus-containing pesticides.** *J. Assoc. Off. Anal. Chem.* 59(5): 1071-1080; 1976. (2 references)

The Raman spectra of malathion, ethion, methyl parathion, parathion, EPN, *O,O*-diethyl- *O*-(2,4-dichlorophenyl) phosphorothioate, dichlorvos, mevinphos, tributyl phosphorotrithioite, and 2,4-dichlorobenzyl tributylphosphonium chloride have been recorded. These spectra are presented, along with tables giving values for the frequencies. (Author abstract by permission)

77-0206. Luke, B. G.; Dahl, C. J. (Dep. Sci., Australian Govt. Anal. Lab., Melbourne 3000, Australia). **Detection of *O,O*-diethyl- *O*-(2,5-dichlorophenyl) phosphorothioate and *O,O*-diethyl- *O*-(3,6-dichloro-2-pyridyl) phosphorothioate in meat fat.** *J. Assoc. Off. Anal. Chem.* 59(5): 1081-1087; 1976. (15 references)

Two previously unreported organophosphorus residues have been detected in meat fat. The first, *O,O*-diethyl-*O*- (2,5-dichlorophenyl) phosphorothioate, apparently results from the debromination of bromophos-ethyl, while the other, *O,O*-diethyl-*O*- (3,6-dichloro-2-pyridyl) phosphorothioate, presumably arises by the monodechlorination of chlorpyrifos. Mass spectral evidence is presented in support of the assigned structures and gas-liquid chromatographic retention data for the reidues and their oxygen analogs are provided. (Author abstract by permission)

77-0207. Dale, W. E.; Miles, J. W.; Churchill, F. C., II. (Bureau Trop. Dis., Cent. Disease Contr., Public Health Serv., Dep. Health Education Welfare, Atlanta, GA 30333). **Gas-liquid chromatographic determination of chlorphoxim residues in water and fish by in-block methylation.** *J. Assoc. Off. Anal. Chem.* 59(5): 1088-1093; 1976. (12

references)

A gas-liquid chromatographic method has been developed for the analysis of residues of chlorophoxim, 2-chloro-α- (((diethoxyphosphinothioyl) oxy)imino)- benzeneacetonitrile, in water and fish. The method is based on the in-block methylation of chlorphoxim with 0.01*M* trimethylanilinium hydroxide in methanol. The derivative, *O,O*-diethyl *O*-methyl phosphorothioate, was determined quantitatively by using a flame photometric detector specific for phosphorus. The in-block reaction is 70% efficient. Water samples were extracted with hexane; fish were extracted with methylene chloride and cleaned up on an acetonitrile-hexane partition column. Recoveries from water and fish samples spiked with chlorphoxim averaged 86.3 and 80.4%, respectively. Limits of detection were 10.0 ppb for 5 g samples of fish and 0.10 ppb for 300 ml water samples. (Author abstract by permission)

77-0208. Stein, V. B.; Pittman, K. A. (Inst. Compar. Hum. Toxicol., Albany Med. Coll., Albany, NY 12208). **Gas-liquid chromatographic determination of azinphos ethyl in human plasma and in mouse plasma, tissue, and fat.** *J. Assoc. Off. Anal. Chem.* 59(5): 1094-1096; 1976. (7 references)

A new method for the determination of azinphos ethyl (*O,O*-diethyl-*S*- (4-oxo-1,2,3- benzotriazin-3 (4*H*)-ylmethyl) phosphorodithioate) in human plasma and in mouse plasma, tissue, and fat has been developed. The method is based on extraction with benzene or hexane and cleanup of fat and tissue samples by a minicolumn containing Florisil and sodium sulfate. Azinphos ethyl is eluted from the column with 10% acetonitrile in benzene and is concentrated to an appropriate volume for gas-liquid chromatographic analysis, using a ^{63}Ni electron capture detector and a glass column containing 3% OV-1 on Gas-Chrom Q. The method is sensitive to 0.005 ppm in human plasma, 0.01 ppm in mouse plasma, 0.08 ppm in mouse liver, 0.05 ppm in mouse brain, and 0.01 ppm in mouse fat. The limit of detection is 2 pg; mean recoveries ranged from 96 to 98%. (Author abstract by permission)

77-0209. Hazemoto, N.; Kamo, N.; Kobatake, Y. (Fac. Pharm. Sci., Hokkaido Univ., Sapporo, Japan). **Ion selective electrode for 2,4-dichlorophenoxyacetic acid.** *J. Assoc. Off. Anal. Chem.* 59(5): 1097-1100; 1976. (16 references)

An electrode responsive to 2,4-D (2,4-dichlorophenoxyacetic acid) was constructed by dissolving tetrazolium derivatives as an ion exchanger in a liquid membrane. The electrode exhibited rapid and Nernstian response to solutions of 2,4-D over the concentration range 10^{-1} to $10^{-4}M$. The presence of diverse substances such as acetate, benzoate, and 3-indole-acetate showed no appreciable effect on the electromotive force of the electrode. (Author abstract by permission)

77-0210. Billings, T. J.; Hanks, A. R.; Colvin, B. M. (Dep. Agric. Anal. Serv., Texas A & M Univ., College Station, TX 77843). **High-performance liquid chromatographic determination of warfarin.** *J. Assoc. Off. Anal. Chem.* 59(5): 1104-1108; 1976. (12 references)

A high-performance liquid chromatographic (HPLC) method for determining warfarin, 3-(α-acetonylbenzyl)- 4-hydroxycoumarin, in rodenticide formulations is described. Samples containing warfarin are ground, extracted 1 hr on a rotary shaker with dioxane-1% sodium pyrophosphate (85+15), centrifuged, and filtered. The filtrate is injected onto an HPLC column containing C_{18}-αBondapak with a pre-column of C_{18}-Corasil. The eluting solvent is 0.0025*N* H_3PO_4-methanol (1+2) at a flow rate of 1.5 ml/min. Chromatography is complete within 10 min and warfarin is detected by ultraviolet absorption at 283 nm. Results indicate good reproducibility with a 2.4% average coefficient of variation for a variety of commercial samples containing 0.025-0.5% warfarin. This method is also applicable to samples containing sodium warfarin. The HPLC method is rapid and specific. Results obtained agree with those from more commonly employed ultraviolet spectrophotometric methods. (Author abstract by permission)

77-0211. Baum, H.; Black, R. F.; Kurtz, C. P. (Rohm and Haas Co., Philadelphia, PA 19137). **Dicofol: collaborative study of the hydrolyzable chlorine method.** *J. Assoc. Off. Anal. Chem.* 59(5): 1109-1112; 1976. (2 references)

A collaborative study was performed on dicofol formulations, using a hydrolyzable chlorine method with a potentiometric end point. Five laboratories each analyzed 2 samples of Kelthane technical, Kelthane MF, Kelthane, EC, and Kelthane 35 in duplicate on each of 2 days. Statistical analysis indicated that the between-laboratory standard deviation of the dicofol assay, excluding outliers, was 0.47, 1.09, 0.78, and 0.99% absolute, at the 20, 39, 44, and 86% assay levels, respectively. The method has been adopted as official first action. (Author abstract by permission)

77-0212. Sasaki, K.; Takeda, M.; Uchiyama, M. (Nat. Inst. Hyg. Sci., Tokyo, Japan 158). **Gas-liquid chromatographic determination of chloramphenicol in agricultural crops.** *J. Assoc. Off. Anal. Chem.* 59(5): 1118-1121; 1976. (9 references)

A method is presented for the gas-liquid chromatographic determination of chloramphenicol in agricultural crops. Chloramphenicol is extracted with ethyl acetate, cleaned up by silicic acid column chromatography, acetylated with acetic anhydride and pyridine, and then measured by gas-liquid chromatography with electron capture detection. Two stationary phases, DEGS + phosphoric acid and Reoplex 400, were used. The sensitivity was ca 8 ng (40% full scale deflection). The efficiency of the analytical method was evaluated by analyzing crops fortified with chloramphenicol. The average recovery

ranged from 72% in unpolished rice to 86% in Chinese radishes. (Author abstract by permission)

77-0213. Yamato, Y.; Suzuki, M.; Watanabe, T. (Kitakyushu Munic. Inst. Environ. Health Sci., Kitakyushu, Japan 804). **Gas chromatographic resolution of organochlorine insecticides on mixed phase systems II. OV-1/OV-25, OV-210/OV-25, and OV-225/OV-25 systems.** *J. Assoc. Off. Anal. Chem.* 59(5): 1180-1183; 1976. (2 references)

The resolution of organochlorine insecticides and related compounds on OV-1/OV-25, OV-210/OV-25, and OV-225/OV-25 mixed phase column systems was investigated. α-BHC, β-BHC, and γ-BHC (lindane) were resolved on the 0.5% OV-210/2% OV-25 system; α-BHC, β-BHC, and γ-BHC were separated on the 0.5% OV-225/2% OV-25 or 1% OV-1/2% OV-25 system. Heptachlor, heptachlor epoxide, aldrin, and endrin were resolved on the 0.5% OV-1/2% OV-25 system. Dieldrin was separated on the 5% OV-25 system. Dieldrin was separated on the the 5% OV-210/2% OV-25 or 5% OV-225/2% OV-25 system. DDT and its related compounds except *p,p'*-DDE and *o,p'*-DDE were resolved on the 5% OV-210/2% OV-25 or 0.5% OV-225/2% OV-25 system. (Author abstract by permission)

77-0214. Eastin, E. F. (Texas Agr. Experiment Stn., Route 5, Box 784, Beaumont, TX 77706). **Separation of bifenox and related compounds by thin-layer chromatography).** *J. Chromatogr.* 124(2): 422-423; 1976.

The chromatographic behavior of bifenox and four of its possible degradation products was investigated. Amounts of 10 μg of bifenox, methyl 5-(2,4-dichlorophenoxy) anthranilate, 5-(2,4-dichlorophenoxy) anthranilic acid, 5-hydroxy-2- nitrobenzoic acid, and 5-dihyroxyanthranilic acid were spotted both separately and together 2 cm from the bottom of the chromatography sheet and developed for 15 cm in a saturated chamber using various solvent systems. No solvent system evaluated would separate all compounds satisfactorily. Bifenox and the first degradation product were separated from one another and the other compounds by several solvent systems, the best being acetone, benzene, benzene-1,2,3- trichloropropane (3:2), and 1,2,3-trichloropropane. Other compounds were separated by benzene-ethanol (2:1), 2-butanone, ethanol, and methanol. The lower limit of detection for these compounds under the conditions of this test was 0.5 μg for bifenox and the first degradation product, and 0.1 μg for the other products.

77-0215. Mattsson, P. E.; Nygren, S. (Nat. Swedish Lab. Agric. Chem., Uppsala, Sweden). **Gas chromatographic determination of polychlorinated biphenyls and some chlorinated pesticides in sewage sludge using a glass capillary column.** *J. Chromatogr.* 124(2): 265-275; 1976. (26 references)

Gas chromatographic methods for the determination of polychlorinated biphenyls and DDT (with some of its metabolites) in sewage sludge samples and similar materials are described. The sample is extracted with a mixture of hexane, acetone and water. After separation, the hexane phase is reduced in volume and divided into two aliquots, one of which is first shaken with 7% fuming sulphuric acid to remove lipids, and then with potassium cyanide to eliminate interference by elemental sulfur. The other aliquot is evaporated to dryness and heated with ethanolic potassium hydroxide. The two aliquots are injected into a gas chromatograph fitted with a glass capillary column and an electron capture detector. Hexabromobenzene is used as an internal standard. Polychlorinated biphenyls are determined quantitatively by comparing the peaks of the sample with those of Clophen A 50 or A 60. The individual percentage composition of the chlorobiphenyls in the polychlorinated biphenyl oils is used. The capillary column is coated with silicone oil SF 96 according to a described procedure. (Author abstract by permission)

77-0216. Leoni, V.; Puccetti, G.; Colombo, R. J.; D'Ovido, A. M. (Inst. Hyg. "G. Sanarelli", Univ. Rome, Rome, Italy). **The use of Tenax for the extraction of pesticides and polychlorinated biphenyls from water. II. Tests with artificially polluted and natural waters.** *J. Chromatogr.* 125(2): 399-407; 1976. (22 references)

The application of Tenax to the extraction of organic micro-pollutants such as pesticides and polychlorobiphenyls from waters has been studied, and it has been observed that also in the presence of other pollutants (oil, surface-active substances, etc.) the results obtained with an absorption column of Tenax-Celite are equivalent to those obtained with the continuous liquid-liquid extraction technique. For natural waters that contain solids in suspension that adsorb pesticides, it may be necessary to filter the water before extraction with Tenax and then to extract the suspended solids separately. Analyses of river and estuarine sea waters, filtered before extraction, showed the effectiveness of Tenax, and the extracts obtained for the pesticides analysis prove to be much less contaminated by interfering substances than the corresponding extracts obtained by the liquid-liquid technique. (Author abstract by permission)

77-0217. Gupta, R. K.; Dutta, T. R. (Indian Grassland and Fodder Res. Inst., Jhansi, India 284001). **Estimation of linuron residues in some fodder crops and soils.** *J. Indian Chem. Soc.* 53(4): 331-429; 1976. (4 references)

A simple, accurate, and reproducible colorimetric method for the extraction and determination of linuron residues in sunflower, oats, soybean fodders, wheat grains and straws and soils is presented. The method consists of quantitative conversion of linuron to 3,4-dichloroaniline which on diazotization with nitrous acid and coupling with

alkaline β-naphthol solution forms a red dye. The absorbance of the dye dissolved in methanol is measured at 540 nm in a photoelectric colorimeter against methanol (40%) as blank. Determination of herbicide in plant and soil samples fortified with known amounts of linuron gave uniform recoveries. The method is useful for estimation of linuron residues in sunflower, oats, soybean fodders, wheat grains and straws and soil with the lower limit of determination being 1 ppm linuron.

77-0218. Bajer-Rapic, B.; Schmid, E. R.; Junger, E.; Pollak, K. (Anal. Inst., Univ. Wien, Vienna, Austria). **Duennschichtchromatographische Trennung und enzymatischer Nachweis von Carbamatpestiziden in Pflanzenextrakten. [Thin layer chromatographic separation and enzymatic detection of carbamate pesticides in plant extracts.]** *Nahrung* 19(7): 551-555; 1975. (8 references) (German)

A thin-layer chromatography technique is presented for the separation of carbamate pesticides from plant material. An enzymatic method for their determination is included. Cellulose plates were impregnated with polar substances (ethylene glycol, triethylene glycol, and β,β'-oxydipropionitrile). Solvents were heptane/chloroform and iso-octane/dioxane. The determination of the pesticides was difficult due to the slight enzyme inhibiting effect and coloration of the plant extracts. However, the separation and detection of methomyl, carbaryl, baygon (propoxur) and aldicarb were achieved. The Rf values of the carbamates were not influenced by the type of plant material used nor by the amount, 50-200 mg.

77-0219. Gupta, R. C.; Dewan, R. S. (Div. Agr. Chem., Indian Agr. Res. Inst., New Delhi 12, India). **Estimation of combined residues of carbofuran (*Furadan*) and its toxic metabolites by enzymatic method.** *Pesticides* 10(4): 38-45; 1976. (4 references)

An enzymatic method is presented for determining the combined residues of carbofuran and its toxic metabolites. The method is based on the color reaction obtained on hydrolysis of the chromogenic substrate by enzyme. Combined residues of carbofuran and its toxic metabolites are presented as carbofuran equivalents calculated on the basis of relative potentialities of the toxicants for enzyme inhibition. Recoveries were determined in fortified extracts to ensure practically quantitative results. The studies allowed the conclusion that carbofuran is 3.61 times more cholinergic than 3-hydroxy carbofuran and 6.67 times more so than 3-keto carbofuran. Results of the estimation of carbofuran and its toxic metabolites in fortified soil and plant samples showed that percent recoveries vary from 84 to 87% in soil samples and 81 to 84% in plant samples. These values may be taken as quantitative and the method can be used for the estimation of toxic entities.

77-0220. Crombie, L.; Pattenden, G.; Simmonds, D. J. (Dept. Chem., The Univ., Nottingham NG7 2RD, England). **Structural and physical aspects of pyrethrum chemistry.** *Pestic. Sci.* 7(3): 225-230; 1976. (6 references)

Recent X-ray and spectroscopic studies of natural pyrethrins are presented; these studies have provided a method for unambiguous detection of the pyrethrin esters and precise information concerning their geometries, useful in structure-activity correlations. Each pyrethrin ester shows a very weak molecular ion and the fragmentation pattern is almost always a direct summation of the fragmentation patterns observed for the component alcohol and acid moieties. The introduction of combined liquid chromatography—field desorption mass spectrometry will aid in detection of pyrethrins in trace amounts. ^{1}H-NMR studies of the pyrethrins have provided information useful in confirming stereochemical detail of the molecules and estimating the relative proportions of various components present in mixtures.

77-0221. Wright, A. N.; Mathews, B. L. (Shell Res. Ltd., Woodstock Lab., Sittingbourne Res. Cent., Sittingbourne, Kent, England). **Development of methods for the analysis of crops and soils for residues of benzoylprop-ethyl and its breakdown products.** *Pestic. Sci.* 7(4): 339-348; 1976. (4 references)

Methods are described for the analysis of residues of the herbicide benzoylprop-ethyl, ethyl (±)-2-[*N*-(3,4-dichlorophenyl) benzamido] propionate, and its breakdown product, (±)-2-[*N*-(3,4-dichlorophenyl) benzamido] propionic acid, in wheat and soil. In wheat the acid degradation product conjugates with plant sugars and the present paper includes methods for determination of these residues either separately or as a combined residue with unconjugated acid. Efficient extraction procedures have been developed together with partition and column chromatograpic techniques for purification of extracts. The full analytical procedures are described and the final determinations are by g.l.c. with electron capture detection with blank values for field samples in the range 0.01-0.05 mg/kg. Good recoveries were obtained. Radiochemical techniques have been used to verify the extraction and subsequent procedures in the methods. (Author abstract by permission)

77-0222. Williams, I. H. (Agric. Canada Res. Stn., Vancouver, BC, V6T 1X2, Canada). **Determination of permethrin by gas-liquid chromatography with electron capture detection.** *Pestic. Sci.* 7(4): 336-338; 1976. (2 references)

A method was developed for determining permethrin in potatoes. The insecticide was extracted with acetone and hexane, and partitioned into ethyl acetate. The extract was purified on a column containing a mixture of alumina, 'Florisil' and silica gel plus a layer of activated charcoal mixed with cellulose. Analysis was by gas-liquid chromatography with electron-capture detection. Recovery from fortified potatoes ranged from 78 to 91% at 0.01

mg/kg and 98 to 107% at 1.0 mg/kg. The method appears to be applicable to other crops; a trial run on fortified bean leaves gave 80% recovery at 0.1 mg/kg. (Author asbstract by permission)

77-0223. Uno, M.; Ueda, E.; Okada, S.; Kagechi, Y. (Nara Prefect. Public Health Res. Lab. Nara, Japan). [**Studies on the degradation products of pesticides remaining in/or crops. Part 1. ETU remaining in/or crops.**] *Proc. Annu. Meet. Food Hyg. Soc. Jpn.* 32: 30; 1976. (Japanese)

Levels of ethylenethiourea and residues of ethylenebisdithiocarbamate fungicides were determined on 64 specimens of 16 kinds of crops. The method of determining ethylenethiourea was based on extraction by methanol plus water (8:2), *S*-benzylation, cleanup with chloroform and benzene, and then extraction by benzene. Identification of ethylenethiourea was performed by mass spectrography. The determination of ethylenebisdithiocarbamates was based on separate determinations of carbon disulfide and ethylenediamine, and the results were calculated as zineb. ETU was found at 0.008-0.076 ppm in one specimen of cucumber and two specimens of strawberry. Ethylenebisdithiocarbamates (as zineb) were present at in 0.34-1.21 ppm one specimen each of strawberry, spinach, and cucumber. It was presumed that the crops in which ethylenebisdithiocarbamates were present contained ETU accounting for about one third of the carbamate.

77-0224. Isshiki, K.; Tsumura, K.; Watanabe, T. (Kita-Kyushu Munic. Inst. Environ. Health., Kitakyushu, Fukuoka, Japan). [**Determination of piperonyl butoxide in crops by high speed liquid chromatography.**] *Proc. Annu. Meet. Food Hyg. Soc. Jpn.* 32: 29; 1976. (1 reference) (Japanese)

To 25 g of crushed and homogenized specimen of brown rice, polished rice, wheat, or barley, 100ml of *n*-hexane was added and the mixture was shaken well. The *n*-hexane extract including *n*-hexane washings was partitioned three times with acetonitrile. The acetonitrile layer was mixed with a 2% aqueous solution of sodium chloride. The aqueous layer was extracted twice with *n*-hexane. Using high speed liquid chromatography the hexane extract was dehydrated and condensed, then thymol was added as internal standard for fluorescence detection. However, for UV detection, the extract was cleaned up with active carbon and *n*-hexane, then piperonyl butoxide was eluted with a mixture of *n*-hexane and chloroform (1:1). The analytical conditions for the high speed liquid chromatography were: column 2.1 mm in diameter by 500 mm in length packed with HITACH-gel, mobile layer ethanol, flow rate 1 ml/min, pressure 80 kg/cm^2; detector with exit wavelength of 290 nm, detecting wave length of 340 nm. The relative retention time of piperonyl butoxide vs. thymol was 2.50. The detection limit was 0.4 ppm by fluorescent detector and 4 ppm by UV detector. The recovery from fortified cereals such as rice, wheat, barley, maize, etc. was 85.5-102%.

77-0225. Murakami, Y.; Maeda, K.; Kashimoto, T. (Osaka Prefect. Inst. Pub. Health, Osaka, Japan). [**Labor-saving method for determining organochlorine pesticide residues and antioxidants in fatty foods.**] *Proc. Annu. Meet. Food Hyg. Soc. Jpn.* 32: 20; 1976. (Japanese)

Instead of the conventional method for separation of fat and other substances for determination in foods, a method using sweep co-distillation (SCD) and/or liquid chromatography was studied for determining BHC and DDT isomers and dieldrin as well as antioxidants such as BHC and BHT. A 2-g fat specimen was dissolved in *n*-hexane to make 10 ml of solution. A 1 ml aliquot of the solution was injected into the Storherr tube for SCD and distillation was carried out with repeated addition of 2 ml of *n*-hexane at 2 min intervals for 30 min. The distillate was determined by gas chromatography after condensation and passing over a Florisil column. In the case of liquid chromatography the fat specimen (5 g) was dissolved in toluene to make 10 ml of solution. Three ml of the solution was poured into a sample tube for liquid chromatography and developed by toluene, discarding the first 24 ml of effluent. The effluent was condensed and gas chromatographed. In the cases of 0.02 ppm of BHC and DDT isomers and dieldrin in sesame oil or in butter, the recovery was better than 80% when determined by SCD and gas chromatography. The method of liquid chromatography was studied only for BHA and BHT in fat, and the obtained recovery ranged from 77 to 90%.

77-0226. Varduca, A.; Luca, C.; Virtosu, D. (Author address not given). **Metode enzimatice de analiza in controlul poluarii apelor cu pesticide.** [**Enzymatic methods of analysis in monitoring pesticide contamination.**] *Rev. Chim. (Bucharest)* 27(4): 350-354; 1976. (10 references) (Romanian)

New techniques and methods which are adaptable for analyzing pesticide contamination in waste and surface waters are presented. Enzymatic methods are among the most practical methods for continuous pesticide monitoring. Characteristics, instruments, and analytical parameters are considered along with calibration techniques for organophosphorus pesticide load estimation in water using anticholinesterase tests. The sensitivity of determination is discussed in relation to the fish toxicity of the pesticides.

77-0227. Kielczewski, W.; Gera, J.; Tomkowiak, J.; Schneider, I. (Inst. Mat. Fiz. Chem., Poznan, Poland). **Oznaczanie drobnych ilosci fluoru w preparatach grzybobojczych.** [**The assay of small fluorine quantities in fungicidal preparations.**] *Rocz. Akad. Roln. Poznaniu* 62: 101-105; 1973. (Polish)

Chromatographic analyses were made of microgram fluorine contents in fungicide preparations. The chromatography paper was impregnated with aluminum and aluminon. The size of the spots obtained on the paper were directly proportional to the amount of fluoride on the paper. Fungicide preparations examined by this method

included Soltox, Fungotox FBF TW, Fungonit NW, Dohnalit ULL, and Dohnalit UALL. The content of fluorine in the fungicides was: 0.1760g in 2.2470 g Soltox; 0.3722 g in 1.8984 g Fungotox FBF TW; 0.2198 g in 1.2445 g Fungonit NW; 0.1900 g in 1.7867 g Dohnalit ULL; and 0.1555 g in 1.2870 g Dohnalit UALL. These results indicate the suitability of this method for fluorine determinations in some funcigidal preparations.

77-0228. Laskowski, K.; Bierska, J. (Author address not given). **Oznaczanie zawartosci DMDT, γ-HCH, DDD, DDT i DDE w mleku i produktach mleczarskich. [Determination of DMDT, γ-HCH, DDD, DDT, and DDE content in milk and dairy products.]** *Rocz. Inst. Przem. Mleczarskiego* 16(2): 77-86; 1974. (14 references) (Polish)

A thin-layer chromatographic method for determining DMDT, γ-HCH, DDD, DDT and DDE in milk and dairy products is presented using an adaptation of Wood's method. Compounds were separated from the isolated fat of the product sample, mixed with Celit 545, eluted by means of dimethylsulfoxide, and then adsorbed on a column packed with Florisil. Pesticides were then eluted with petroleum benzin and, after concentration, were determined by thin-layer chromatography. Silica gel was used as the solid phase, and a mixture of *n*-hexane and acetone in a 98:2 ratio formed the mobile phase. Morley and Chib reagent was used to develop the chromatograms, and they were UV-irradiated. Recovery rates for DMDT, DDE, and DDT were about 97%. For DDD, 90%, and for γ-HCH, 83% recovery rates were obtained. The method is accurate to ± 0.008 ppm for DMDT, DDE, DDT, and DDD, and to ± 0.040 ppm for γHCH. Results are reproducible for levels of 0.02 ppm for DMDT, DDD, DDT and DDE. This method is thus relatively accurate, simple and rapid in operation.

77-0229. Ueda, K.; Someya, N.; Tojo, K.; Yatomi, A.; Kawai, M.; Maruta, H. (Sch. Oral Hyg., Showa Univ., Tokyo, Japan). **[Comparison of methods of cholinesterase activity determination, DTNB-colorimetric and pH-decrease.]** *Sangyo Igaku (Jpn. J. Ind. Health)* 18(3): 220; 1976. (Japanese)

Two methods, the pH-decrease method of Michel and the ATCh-DTNB method of Moss (with some refinements) were applied in determining the plasma and erythrocyte ChE activity of workers in a pesticide factory. There were 81 pesticide handling persons and 48 persons not handling pesticides. Out of 262 samples taken for determination of plasma ChE activity, the correlation coefficient between the results by the two methods was 0.660. The rate of reduction of erythrocyte ChE activity determined by the pH decrease method on pesticide-exposed employees coincided very well with the rate of reduction of whole blood ChE activity. It was concluded that the ATCh-DTNB method on whole blood was more appropriate for mass examinations in factories where employees are exposed to anticholinesterase agents.

77-0230. Tsvetkova, T.; Kristodorova, V.; Sergeeva, D. (Vet. Inst. Infect. Parasit. Dis., Sofia, Bulgaria). **Enzimen tunkosloinoklromatografski metod za identifitsirane na nyakoi fosfororganichni pestisidi. [An enzyme thin layer chromatography method for the identification of some organophosphorus pesticides.]** *Vet. Med. Nauki* 11(6): 50-53; 1976. (5 references) (Bulgarian)

A sensitive thin-layer chromatographic method is described for determining pure organophosphorus pesticides. Pesticides tested included Fak-40, parathion, Bi-58 (dimethoate), gusathion (azinphosethyl), intrathion (thiometon), and phosdrin. The pesticides are spotted on a thin layer (0.3 mm) of silica gel DG. The plates are developed in a mobile phase, air-dried and treated with bromine until a yellow tint appears, which usually takes 1 to 3 minutes. They are sprayed with an enzyme solution, dried again, and then developed with α-naphthylacetate and a diazo salt. Characteristic spots appear in the inhibition zone. The sensitivity of the method is 0.5 ppm for all types of pesticides and it is readily employed.

77-0231. Berge, H.; Reinke, H. (Sekt. Chem., Univ. Rostock, Rostock, DDR). **Polarographische Untersuchungen zur Bestimmung zweier Carbamoyloximderivate. [Polarographic investigations on the determination of two carbamoyloxime derivatives.]** *Wiss. Z. Univ. Rostock Math.-Naturwiss. Reihe* 22(3): 381-383; 1973. (3 references) (German)

A study was made of the polarographic behavior of *O*-(*N*-phenylcarbamoyl)- propanoneoxime and *O*-(*N*-(*p*-bromophenyl)- carbanoyl)- propanoneoxime in various supporting electrolytes using the dropping mercury electrode. The influence of some metal ions on the polarographic current is described. Various methods are proposed to determine the two substances.

77-0232. Konobu, K.; Takeda, T. (Osaka Coll. Pharm., Kawai, Matsubara City, Osaka, Japan). **[Microassay for blood cholinesterase activity by fluorometric titration.]** *Yakugaku Zasshi* 95(8): 906-910; 1975. (6 references) (Japanese)

An improved method for the microassay of blood cholinesterase activity has been developed. The method calls for application of a fluorometric titration for acetic acid. The reaction mixture is composed of 100 μl substrate, 50 μl Tris buffer (pH 7.6), and 50 μl of sample. This mixture is incubated for 10 to 20 min at 30°. Umbelliferone (1000 μl, $10^{-6}M$) is added to the mixture. After centrifuga-

tion a 1000 μl aliquot of isopropanol supernatant containing 0.2-15 μmoles of acetic acid is titrated by fluorometry with 0.02 *N* isopropanolic NaOH. Within 40 min of incubation linearity of the reaction rate is achieved. This method may be employed for colored and insoluble materials such as erythrocytes just as it is used in the case of serum.

See also **77-0181**

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